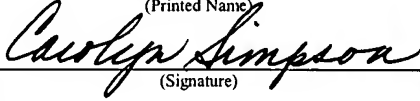


IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Arnold-Huyser et al.
 Title: POINT-OF-INTEREST
 DISPLAY SYSTEM
 Appl. No.: 10/532,025
 International Filing Date: 10/20/2003
 371(c) Date: 04/21/2005
 Examiner: To Be Determined
 Art Unit: To Be Determined
 Conf. No.: 8239

CERTIFICATE OF EXPRESS MAILING	
I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.	
EV 962268692 US (Express Mail Label Number)	2/7/07 (Date of Deposit)
Carolyn Simpson (Printed Name)	
 (Signature)	

TRANSMITTAL

Mail Stop PCT
 Commissioner for Patents
 Office of PCT Legal Administration
 P.O. Box 1450
 Alexandria, VA 22313-1450

Attn: Office of PCT Legal Administration

Sir:

Transmitted herewith are the following documents for the above-identified application:

- ☒ [X] Renewed Petition Under 37 C.F.R. 1.47(a) (4 pages)
- ☒ [X] Exhibit A (2 pages), Exhibit B (1 page), Exhibit C (1 page), Exhibit D (1 page), Exhibit E (88 pages), Exhibit F (36 pages), Exhibit G (1 page), Exhibit H (1 page), Exhibit I (30 pages), Exhibit J (29 pages), Exhibit K (29 pages), Exhibit L (13 pages), Exhibit M (13 pages), Exhibit N (10 pages), Exhibit O (1 page), Exhibit P (3 pages), Exhibit Q (3 pages)

[X] Applicant hereby petitions for an extension of time under 37 C.F.R. §1.136(a) for the total number of months checked below:

[X] Extension for response filed within the first month:	\$120.00	\$120.00
[] Extension for response filed within the second month:	\$450.00	\$0.00
[] Extension for response filed within the third month:	\$1,020.00	\$0.00
[] Extension for response filed within the fourth month:	\$1,590.00	\$0.00
[] Extension for response filed within the fifth month:	\$2,160.00	\$0.00
EXTENSION FEE TOTAL:		\$120.00
[] Statutory Disclaimer Fee under 37 C.F.R. 1.20(d):	\$130.00	\$0.00
CLAIMS, EXTENSION AND DISCLAIMER FEE TOTAL:		\$120.00
[] Small Entity Fees Apply (subtract ½ of above):		\$0.00
Extension Fees Previously Paid:		\$0.00
TOTAL FEE:		\$120.00

A credit card payment form in the amount of \$120.00 is enclosed.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by the credit card payment form being unsigned, providing incorrect information resulting in a rejected credit card transaction, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447.

If any extensions of time are needed for timely acceptance of papers submitted herewith, applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 06-1447.

02/09/2007 LLANDGRA 00000016 10532025

01 FC:1251

120.00 0P

Please direct all correspondence to the undersigned attorney or agent at the address indicated below.

Respectfully submitted,

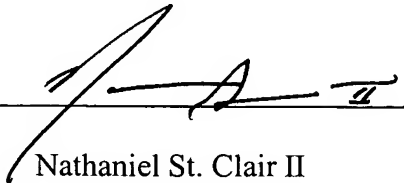
Date 2/7/07

FOLEY & LARDNER LLP

Customer Number: 26371

Telephone: (414) 297-5845

Facsimile: (414) 297-4900

By 

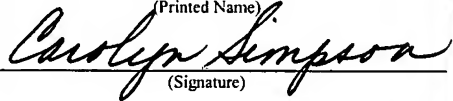
Nathaniel St. Clair II

Attorney for Applicant

Registration No. 57,498

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Arnold-Huyser et al.
Title: POINT-OF-INTEREST DISPLAY
SYSTEM
Appl. No.: 10/532,025
International 10/20/2003
Filing Date:
371(c) Date: 04/21/2005
Examiner: To Be Determined
Art Unit: To Be Determined
Conf. No.: 8239

CERTIFICATE OF EXPRESS MAILING I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.	
EV 962268692 US (Express Mail Label Number)	2/7/07 (Date of Deposit)
Carolyn Simpson (Printed Name)	
 (Signature)	

RENEWED PETITION UNDER 37 C.F.R. 1.47(a)

Mail Stop PCT
Commissioner for Patents
Office of PCT Legal Administration
P.O. Box 1450
Alexandria, VA 22313-1450

Attn: Office of PCT Legal Administration

Sir:

Applicants hereby petition the Commissioner under 37 C.F.R. §1.47 to accept the Declaration and Power of Attorney in the above-referenced application, in order to preserve the rights of the Applicants.

A petition under 37 C.F.R. 1.47(a) must be accompanied by: (1) the fee under 37 CFR 1.17(h); (2) factual proof that the missing joint inventor refuses to execute the application or cannot be reached after diligent effort; (3) a statement of the last known address of the missing inventor; and (4) an oath or declaration by each 37 CFR 1.47(a) applicant on his or her own behalf and on behalf of the non-signing joint inventor.

The party to which the Applicants have agreed to assign the invention have made a *bona fide* attempt and diligent effort to comply with the provisions of 37 C.F.R. §1.47, by attempting to contact the non-signing inventor, Mr. John S. Bambini, in order to execute the application, on multiple occasions. To date, Mr. Bambini has failed to execute the above-referenced application and return it to the party to which the Applicants have agreed to assign. Therefore, the Applicants petition the Commissioner to accept the Declaration and Power of Attorney previously filed by the Applicants, in order to preserve their rights.

Enclosed herewith:

Exhibit A is a copy of the letter sent to Mr. John Bambini on January 31, 2007 requesting his cooperation and signatures. The copy states that assignment and declaration documents were enclosed with the letter and complete copies of the patent applications, including the specifications, claims, and drawings were also enclosed.

Exhibit B is a copy of the certified mail receipt as sent with the letter.

Exhibit C is a copy of the postage paid return envelope that was enclosed with the letter.

Exhibit D is a copy of Mr. Bambini's employment agreement that was enclosed with the letter.

Exhibit E is a copy of all three complete patent applications that were enclosed with the letter (including attorney docket nos. 026032-4899, 026032-4900, and 026032-4901), including the specification, drawings, and claims.

Exhibit F is a copy of the assignment and declaration papers sent to Mr. Bambini and enclosed with the letter.

Exhibit G is a copy of the executed receipt of certified mail and certified mail domestic return receipt. These documents show that the letter and package including complete copies of all three patent applications were received at Mr. Bambini's last known address. We have not received a response to this letter.

Exhibit H is an e-mail sent on January 31, 2007 requesting Mr. Bambini's cooperation and signatures.

Exhibits I-O are the documents attached to the e-mail sent on January 31, 2007. Please note that complete copies of application papers (including drawings, specification, and claims) were attached, as well as copies of the assignment and declaration documents.

Exhibit P is a copy of a response e-mail sent by Mr. Bambini.

Exhibit Q is a copy of the previously filed affidavit of Ms. Jodi Hemmeke detailing the numerous previous attempts to contact and gain the cooperation of Mr. Bambini.

Please allow us to reiterate that both the January 31, 2007 e-mail and the January 31, 2007 letter included a presentation of a complete copy of the "application papers (specification including claims, drawings, and an oath or declaration)." MPEP § 409.03(d), item II. Applicants believe that they have now shown that Mr. Bambini refuses to cooperate. Both the e-mail and the letter appear to have been received by Mr. Bambini and included complete copies of the subject application. Applicants believe item (2) of 37 C.F.R. 1.47(a) is now satisfied and respectfully request that this renewed petition under 37 C.F.R. 1.47(a) be granted.

The fee set forth in 37 C.F.R. §§ 1.17(h) for filing a petition by other than all the inventors is \$200.00. A credit card payment for this amount was submitted with the petition filed on February 23, 2006 and is not required for submission with this renewed petition.

In compliance with the requirements of 37 C.F.R. §§ 1.47(a), the last known address of the non-signing inventor is as follows:

Mr. John S. Bambini
5490 Brattleboro Dr. SE
Kentwood, MI 49508-6302

The Commissioner is hereby authorized to charge any additional fees, including fees for extensions of time, which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 06-1447. Should no proper payment be enclosed herewith, as by the credit card payment form being unsigned, providing

incorrect information resulting in a rejected credit card transaction, or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 06-1447.

Respectfully submitted,

Date 2/7/07

FOLEY & LARDNER LLP
Customer Number: 26371
Telephone: (414) 297-5845
Facsimile: (414) 297-4900

By 

Nathaniel St.Clair, II
Attorney for Applicant
Registration No. 57,498

Certified Article Number

7160 3901 9849 6402 1183

SENDERS RECORD

January 31, 2007

WRITER'S DIRECT LINE
414.297.5845
nstclair@foley.com EMAIL

CLIENT/MATTER NUMBER
26032-4899

Mr. John S. Bambini
5490 Brattleboro Dr. SE
Kentwood, MI 49508-6302

Re: Assignments & Declarations and Power of Attorney for Patent Applications
Applicant: Arnold-Huyser et al.
Title: POINT-OF-INTEREST DISPLAY SYSTEM
Filing Date: April 21, 2005
F&L File Nos.: 026032-4899, 026032-4900, 026032-4901

Dear Mr. Bambini:

I represent Johnson Controls, Inc. ("JCI"), in the above-referenced patent matters. I have attempted to contact you on multiple occasions to remind you of your obligations to JCI, regarding the execution of certain necessary papers for the above-referenced patent matters.

Per the enclosed document entitled "Employee Innovation and Non-Disclosure Agreement, you entered into an agreement with Prince Corporation (now owned by JCI) to execute "all necessary papers and provide proper assistance *during or subsequent to your employment*, to enable the company to obtain for itself patents, copyrights, or other legal protection for such inventions or innovations."

I have also enclosed a postage-paid, self-addressed envelope and the necessary papers for you to execute, including the (i) Assignments and (ii) Declarations and Power of Attorney for each of the above-referenced patent applications, in order for you to comply with your contractual obligations to JCI. I have also enclosed complete copies of the patent applications, including the specification, claims, and drawings. Your immediate attention and return of the executed documents prior to **Wednesday, February 7, 2007**, would be greatly appreciated. If you have any questions regarding the content of this letter or any other communication(s) regarding this matter, please do not hesitate to contact me.

BOSTON
BRUSSELS
CHICAGO
DETROIT
JACKSONVILLE

LOS ANGELES
MADISON
MILWAUKEE
NEW YORK
ORLANDO

SACRAMENTO
SAN DIEGO
SAN DIEGO/DEL MAR
SAN FRANCISCO
SILICON VALLEY

TALLAHASSEE
TAMPA
TOKYO
WASHINGTON, D.C.



FOLEY & LARDNER LLP

Mr. John Bambini
January 31, 2007
Page 2

Best regards,

A handwritten signature in black ink, appearing to read 'Nathaniel St. Clair II'.

Nathaniel St. Clair II

Enclosures

Cc: Joseph N. Ziebert (w/o enclosures)

7160 3901 9849 6402 1183

TO: Mr. John S. Bambini
5490 Brattleboro Dr. SE
Kentwood, MI 49508-6302

EXHIBIT B

SENDER: NSTC

REFERENCE: 026032-4899

PS Form 3800, January 2005

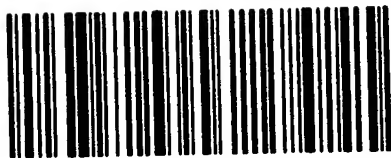
RETURN RECEIPT SERVICE	Postage	
	Certified Fee	
	Return Receipt Fee	
	Restricted Delivery	0.00
	Total Postage & Fees	0.00

US Postal Service
**Receipt for
Certified Mail**

POSTMARK OR DATE

PLACE STICKER AT TOP OF ENVELOPE TO THE RIGHT
OF RETURN ADDRESS. FOLD AT DOTTED LINE

CERTIFIED MAIL



7160 3901 9849 6402 1183

RETURN RECEIPT REQUESTED

FOLEY

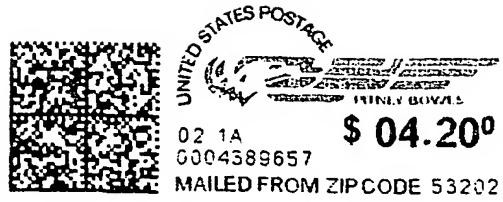
FOLEY & LARDNER LLP

777 EAST WISCONSIN AVENUE
MILWAUKEE, WI 53202-5306

026032-4899

3983 (NSTC)

Mr. John S. Bambini
5490 Brattleboro Dr. SE
Kentwood, MI 49508-6302



FOLEY

FOLEY & LARDNER LLP

777 EAST WISCONSIN AVENUE
MILWAUKEE, WI 53202-5306

026032-4899

3983 (NSTC)



MR. NATHANIEL ST. CLAIR II
FOLEY & LARDNER LLP
777 EAST WISCONSIN AVENUE
MILWAUKEE, WI 53202-5306



PRINCE

EMPLOYEE INNOVATION AND
NON-DISCLOSURE AGREEMENT

In consideration of my original and/or further employment with Prince and of the salary or wages paid to me, I agree:

- a to disclose and assign to Prince all inventions and technical or business innovations conceived or developed by me or jointly with others within the period of my employment, that relate to in any way the company's present and known products, processes, or machines, whether they are existing or reasonably anticipated.
- b to execute, upon the company's request and expense, all necessary papers and provide proper assistance during or subsequent to my employment, to enable the company to obtain for itself any patents, copyrights, or other legal protection for such inventions or innovations.
- c to make and maintain for the company adequate and current written records of all such inventions or innovations.
- d not to use, publish, or otherwise disclose (except as required in my normal company duties), either during or subsequent to my employment, any secret or confidential information or data concerning the company, its products and processes, or its customers.
- e to, upon my termination of employment, promptly deliver to the company all drawings, blueprints, manuals, letters, notes, note boards, reports and all materials of a secret or confidential nature, relating to the company's business, and which are in my possession or control.

Witness: Prince ShermanSignature: John A. BombusDate: 12-2-96

POINT-OF-INTEREST DISPLAY SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a display system for a vehicle and particularly to one which provides a display of selected names of points of interest arranged by category and elemental directions to a selected point of interest. One embodiment provides a graphic display of cross-streets or addresses as the vehicle travels along a local roadway.

There exist numerous vehicle navigation systems which provide graphic map displays, which allow the vehicle operator, through significant manipulation of controls, to plan a travel route and obtain information about arrival destinations, typically by address. Some systems provide navigation control through the use of voice recognition programs and control circuits. All of these systems are relatively expensive, complicated and difficult for a vehicle operator to utilize, particularly when preoccupied with surrounding traffic in congested areas. Some suggested simplified navigation systems allow the vehicle operator to either identify his or her current location by street address and forthcoming intersection information, as well as basic points of interest information. Such systems are relatively inexpensive but do not provide the operator with the flexibility of providing points-of-interest information in a user-friendly format nor additional desirable features, such as easily accessible alternate displays of forthcoming highway exits, street intersections, or street addresses when traveling on a local street.

Thus, there remains a need for a display system for a vehicle which is relatively inexpensive and is user-friendly to operate using a minimum number of intuitive controls. Such a system needs to provide desirable features, such as points of interest in selected categories which can be easily accessed with minimal operator intervention and yet provide the operator with sufficient information to be able to locate and travel to such points-of-interest.

SUMMARY OF THE INVENTION

The system of the present invention satisfies this need by providing a point-of-interest display system in which an updateable database includes road network information, which can be updated at relatively infrequent time intervals, and point-of-

interest information which can be user-updated at more frequent intervals, as new points of interest become available. In a preferred embodiment of the invention, the database is carried on the vehicle in the form of a flashcard or other removable memory device or loaded into flash memory residing in the vehicle via a data communication system. The database interfaces with a microprocessor on the vehicle which receives data from a current position detector, such as a GPS receiver, providing the system with current vehicle location and direction of travel information. A display provides the operator textural and elemental graphic display information, and one or more control switches are positioned in an easily accessible location within the vehicle such that the operator, by scrolling through displayed highway exits, can select categories of points of interest, and points of interest within a category upon the actuation of a minimal number of switches in an intuitive sequence.

In one embodiment of the invention, two modes of operation provide point-of-interest information either while the vehicle is traveling on a limited access highway or, once the vehicle has exited the highway, provides more specific point-of-interest directions. In another embodiment of the invention, the operator can, when on a local road, select the textural display of forthcoming and past intersecting streets, which is updated as the vehicle travels along the roadway. In yet another embodiment of the invention, the navigation system provides a display of the street addresses on which the vehicle is traveling and increments, decrements, or otherwise updates the address as the vehicle moves. In a preferred embodiment of the invention, each of these features are incorporated in a system which allows selection between the features, either manually or automatically as the vehicle moves between a limited access highway and a local roadway.

These and other features, objects and advantages of the present invention will become apparent upon reading the following description thereof together with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a fragmentary perspective view of a vehicle having a point-of-interest display system embodying the present invention;

Fig. 2 is an enlarged fragmentary view of the system shown in Fig. 1;

Fig. 3 is a block electrical diagram showing one interface connection of the system to the vehicle power system;

Fig. 4 is a block electrical circuit diagram of the point-of-interest system including its major components;

Fig. 5 is a flow diagram showing the menu operation for operation of the system shown in Figs. 1-4;

Fig. 6 is the display screen for the main menu;

Fig. 7 is the display screen illustrating the information displayed to the vehicle operator when in a highway point-of-interest mode of operation;

Figs. 8A and 8B are alternate display screens illustrating the information displayed to the vehicle operator when in a local point-of-interest mode of operation;

Fig. 9 is the display screen illustrating the information displayed to the vehicle operator when in a street-address mode of operation;

Fig. 10 is the display screen illustrating the information displayed to the vehicle operator when in a street-sign or cross-street mode of operation;

Fig. 11 is the display screen illustrating the information displayed to the vehicle operator when in a current-information mode of operation;

Fig. 12 is the display screen illustrating the information displayed to the vehicle operator when the lodging category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 13 is the display screen illustrating the information displayed to the vehicle operator when the food category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 14 is the display screen illustrating the information displayed to the vehicle operator when the gas category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 15 is the display screen illustrating the information displayed to the vehicle operator when a particular point of interest in the highway mode has been selected;

Fig. 16 is the display screen illustrating the information displayed to the vehicle operator when the vehicle is out of the coverage zone;

Fig. 17 is the display screen illustrating the information displayed to the vehicle operator during initial start up when the GPS receiver is looking for satellites;

Fig. 18 is the display screen illustrating the information displayed to the vehicle operator when no point of interest was found at a selected exit;

Fig. 19 is the display screen illustrating the information displayed to the vehicle operator in the event a memory card has not been inserted into the circuit;

Fig. 20 is a flow diagram of the operation of the system during start up and shut down;

Fig. 21 is a flow diagram of the normal operation mode of the system; and

Figs. 22A, 22B, and 22C are a detailed flow diagram of the programming of the system during operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring initially to Fig. 1, there is shown a vehicle 10, such as an automobile, van, sports utility vehicle, truck, or the like, which incorporates a point-of-interest display system of one embodiment of the present invention. The point-of-interest display system 20 is mounted in one embodiment in an overhead console 30, although it can be mounted at any conveniently accessible location within easy reach of the vehicle operator, such as in the instrument panel. The point-of-interest system includes a switch group 24 and a display section 26, shown in detail in Fig. 2. The point-of-interest system can be mounted within a housing 22, which includes both the display 26 and switch section 24, as well as a memory card slot 28 for receiving a removable memory card 29, such as a flashcard on which the point-of-interest and road network data is programmed. Alternatively, separate mounting of the components is possible.

The memory card 29 typically will be at least a 128 meg card, although 256 or 512 meg cards may be preferred. The memory card is removable from slot 28, such that data thereon, including road network information and point-of-interest (POI) information, can be separately programmed in layers thereon, such that the road network and POI data can be refreshed at different, periodic intervals. Memory card 29 includes nonvolatile memory and contains a handshake code to communicate with a microprocessor 50 (Fig. 4) of the system, so the microprocessor can read data on the memory card 29. The system, as seen in Fig. 4, also includes a programmable SRAM memory 31, which contains the program for the sequential operation of the system, as shown in Fig. 5. The flow diagram for the program is shown in Figs. 22A, 22B, and 22C, described below. In one embodiment memory card 29 can be obtained from a car

dealer with an update subscription service for refreshing the data on the card either annually, in the case of road network information, or more frequently as new points of interest may become available, such as, for example, on a monthly basis. Alternatively, the user may subscribe to a web site providing download information for refreshing the data on memory card 29 on a personal computer if desired. Card 29 may also be updated through other means. Typically, the memory card will have data sufficient for a regional area in which the vehicle normally travels and will contain points of interest according to categories, such as gas, food, and lodging, as well as all the major (*i.e.*, limited access) and secondary road identifications and street addresses for secondary roads.

The map database is composed of at least two layers, at least one of which includes data like points of interest that change frequently. It is, therefore, desirable to update this information frequently. Another layer or layers of data contain information like the road network that may be undated less frequently. The data layers are linked and each layer may be updated either independently or in combination with other layers. This allows the consumer to obtain updated information without excessive download time when refreshing the data through the Internet, since the update can be limited to the part of the data that changes frequently.

Each layer is contained within a single file on the flashcard 29 for a given geographical area. Every POI record, whether for highway or local coverage, references a street name record in the road network file. This reference is stored in the POI file as an index into the street name table in the road network file.

As the latest POI information is released and compiled, every POI file that is created is associated with the latest road network file available. In addition, any new points of interest that are associated with roads that are not yet compiled into the latest road network file are added to the POI file but are flagged as being without a street name. All other POI attributes, such as telephone number, latitude/longitude and name, are still available in this case. Details of some aspects of the programming of they system to provide the various modes of operation are disclosed in Application No. 60/419,934, entitled **SYSTEM AND METHOD FOR DISPLAYING VEHICLE LOCATION AND POINT OF INTEREST INFORMATION**, the disclosure of which is incorporated herein by reference and in connection with the flow diagrams of Figs. 22A-22C.

The system, as best seen in Fig. 4, includes a current location detection device, such as GPS receiver 40, having an antenna 42 for receiving global positioning satellite signals from multiple satellites and providing current location data to one or more microprocessor(s) 50, which can be a Motorola MC9512DJ64 or its equivalent, through a universal asynchronous receiver/transmitter connection 44. Other current location detection sources of data, such as a Loran receiver, gyro compass, or dead reckoning information sources, may also be employed but a GPS receiver represents the current best mode of receiving such data. The microprocessor receives vehicle location data from the GPS receiver and point-of-interest and road network data from the flashcard 29, which is inserted into slot 28 and coupled to the one or more microprocessor(s) 50. An SRAM memory 31 is also coupled to the microprocessor(s) 50 and contains the system program. The microprocessor is also coupled to one or more operator-actuated switches in the switch section 24 and to a display 26, such as a dot matrix display, for selectively displaying information, such as shown in Figs. 2 and 6-19, to the vehicle operator.

The point-of-interest circuit 20 is coupled to the vehicle power system, as shown in Fig. 3, and includes an ignition input for receiving power when the ignition is either in the run or accessory position, a B+ input drawing a maximum of 300 micro amps when the system is deactivated, a coupling to the system ground and a pulse width modulated dimming input circuit for dimming the back-lighted switches of the switch bank 24 and the dot matrix display 26 based upon the operator's selected lighting level for instrument displays. In some installations, the system could be coupled directly to the vehicle's power supply through the ignition switch and vehicle ground. In another, dimming information is received from the vehicle bus. The microprocessor 50 is also coupled to other vehicle systems, such as a vehicle compass 46 for displaying in the normal mode of operation, when the point-of-interest system is not being employed, the outside temperature, the compass heading, the time and date information, as seen in Fig. 11. The microprocessor may also be coupled to and employed for other vehicle control functions, such as a Homelink® brand programmable transmitter 48, and may be coupled to the vehicle bus 49 for receiving PWM dimming information, ignition run, accessory information, and the like. An outside temperature sensor and circuit 45 may be coupled to the microprocessor(s) 50 or the vehicle bus 49, as shown in Fig. 4, to provide the

temperature display as seen in Fig. 11. Also, a trip computer 47 may be coupled to the microprocessor(s) 50 or to the vehicle bus 49, as shown in Fig. 4, to provide typical trip functions, such as a resettable odometer, fuel consumption, average speed, and estimated time of arrival information, which can be displayed on display 26.

The user-friendly, intuitive switch controls 24 are seen in Fig. 2 and incorporate a menu switch 60, a scroll forward switch 61, a scroll back switch 62, which are physically positioned on the console pointing in a forward and rearward position, respectively, with arrows thereon so as to intuitively indicate to the vehicle operator that the actuation of the scroll switches advances the display to a point of interest or highway exit forward or behind the vehicle. The switch controls 24 also includes a select switch 63 for selecting a given entry highlighted by the movement of a display cursor 27 (Fig. 8) through actuation of scroll switches 61 and 62 and a back switch 64, which allows the operator to move back one entry. Additionally, keys 65, 66, and 67 are provided and are aligned with display icons showing "gas", "food", and "lodges", respectively, as seen in Fig. 2. When the system is employed with a HomeLink® brand trainable transmitter, the switches can, when the POI system is off (Fig. 6), provide the dual function of operating any one of the three programmed transmitting frequencies and codes for up to three different garage doors, home appliances, security gates, or the like.

The operation of the system seen in Figs. 1-4 is best understood by reference to the program flow diagram of Figs. 22A, 22B, and 22C together with the menu diagram with Fig. 5 in connection with the displayed information, as seen in Figs. 2 and 6-19. Initially, when this system is powered up, as shown in Fig. 20, the system searches for satellites and displays a message, as shown by Fig. 17. In the event a memory card or flashcard 29 has not been inserted, the system displays the message shown in Fig. 19, either that the "memory card is not inserted" or the message shown in Fig. 16, that "the vehicle is out of the current data coverage zone." Assuming the memory card is in place and the vehicle is in the data coverage zone and satellite signals have been received, the display screen of Fig. 6 is displayed allowing the operator the option of selecting points of interest (POI) by scrolling, utilizing switches 61 and 62, current information which provides any combination of the compass heading, time, date, and/or outside temperature information of Fig. 11 or trip computer information (not shown). The operator may also select the street sign selection showing either the address of a street on

which the vehicle is traveling, if on a secondary road, as shown by Fig. 9, or, if the scroll button is advanced and street signs has previously been selected, to the street sign display of Fig. 10.

Assuming the vehicle is on a limited access highway and the operator has selected "points of interest" by scrolling to move the cursor 27, shown in Fig. 6, to the "points of interest" selection, the operator enters select by actuating switch 63, and the highway point-of-interest mode, as shown in Figs. 2 and 7, is displayed on display 26. Such display provides information as to points of interest according to categories of gas, food, or lodging, which are displayed as shown by display icons 71, 73, and 75 in Figs. 2 and 7. Display 26 also displays the forthcoming exit which the vehicle is approaching, as indicated by display area 72 (Fig. 7), the name of the street associated with the exit, as indicated by display element 74, and the distance to the exit, as shown by display element 76. To the left of display icons 71, 73, and 75 is a numerical display 80 for indicating the number of gasoline stations available at that exit (*i.e.*, 4 for exit 102a), a numerical display 82 indicating the number of restaurants available at that exit (*i.e.*, 10), and a numerical display 84 indicating the number of lodges or sleeping accommodations available at that exit (*i.e.*, 3). By actuating scroll switches 61 or 62, the operator can scroll forward to display, for example, the information available at the next exit (No. 103, for example) or the previous exit (No. 101, for example) if at exit 102 a desired POI is not available. Thus, while in the highway POI mode, the vehicle operator can look ahead or behind for points of interest and, as discussed below, select and review available points of interest at a selected exit. This enables the operator to find, for example, a favorite restaurant while traveling when meal time is approaching.

As the vehicle travels along the highway, the operator can actuate any one of the three keys 65, 66, or 67 aligned above the display 81 of "gas", display 83 of "food", or display 85 of "lodges", respectively, to select details of the establishments in the available categories at a selected exit. Thus, if the gas key 65 is actuated, the display of Fig. 14 appears, and the "gas" icon 81 is illuminated. The display of Fig. 14 provides three service stations available at the selected exit and their distance. A similar display presentation for restaurants is shown in Fig. 13 and for lodging is shown in Fig. 12.

The operator then can scroll to the desired establishment, such as a Marathon station, as shown in Fig. 14, by actuation of switches 61 and 62 and select the

establishment aligned with the cursor 27 to be presented with a more detailed route to point-of-interest display, as shown in Fig. 15. In Fig. 15, the operator has scrolled up to the Marathon station and actuated the select switch 63. The detail display 87 shows the distance to the Marathon station (*i.e.*, 5.7 miles), and an arrow 88 shows the general direction of the station. The street address 89 of the service station, as well as its telephone number 89'. As the vehicle travels to the exit from which the POI was selected in the highway mode, this information is dynamically updated. Thus, arrow 88 changes direction and the distance information 87 of Fig. 15 is continuously updated. The distance displayed is the combined distance to the exit and from the exit to the Marathon station.

When the vehicle exits the highway, for example, at exit 102A, as shown in Fig. 7, the microprocessor detects from GPS signal and stored road network data programmed in the memory 31 that it is on a secondary road and automatically switches to one of the local point-of-interest displays shown in Figs. 8A or 8B, which, unless a POI has previously been selected as seen in Fig. 15, automatically displays the categories of points of interest available, the number of points of interest in each category through the icons 71, 73, and 75, and the nearest points of interest within a selectable range of, for example, two to four miles of the nearest points of interest regardless of the category. Again, the operator can select any one of the categories by actuating the switches 65, 66, and 67 after which the selected category will be displayed as shown in Figs. 12-14, and a go-to point of interest can be selected by movement of the cursor through actuation switches 61 and 62 and entry of a highlighted point of interest by select switch 63 to obtain the information for that point of interest, as represented, for example, by Fig. 15. If a POI had previously been selected, the display of Fig. 15 remains displayed to the operator.

If there are no points of interest found at a forthcoming exit, the display of Fig. 18 is displayed to the vehicle operator indicating that, at that exit, no selected category points of interest are available. The operator can either scroll forward to exits ahead of the vehicle or scroll backward using switches 61, 62 to a previous exit to look for a desired point of interest and determine which is the closest point of interest which satisfies the operator's needs. If on a local road and no POI are found within an initial

search range, the system will expand the search range until a POI is found and display either the Fig. 8A or Fig. 8B display to the operator.

In addition to the point-of-interest mode of operation, the operator can enter the street sign mode from the main menu by pushing the menu switch 60 and scrolling to street signs (Fig. 6). By actuating the select switch 63, the display of Fig. 9 is presented to the operator, which shows the direction 91 of travel of the vehicle, the road 92 on which the vehicle is traveling, and a street address display 93, which shows the street numbers and which increments or decrements as the vehicle travels along the street, to provide the operator with the ability to locate a point of interest which may have previously been identified by street number or is otherwise known to the operator. This display is particularly helpful where the point of interest is set back from the road, such as, for example, in a shopping mall or the like, and the address is not readily visible from the road. As is well known, the displayed address is interpolated from two known locations and the current vehicle position with respect to such locations as determined by the GPS information.

If the operator scrolls forward utilizing switch 61 while in the street sign mode displaying addresses, as shown in Fig. 9, the system enters the display of cross streets, as shown in Fig. 10, in which two streets ahead of the vehicle (*e.g.*, Second Avenue and Third Avenue in Fig. 10) are presented, as are arrows 94 indicating the location of the vehicle between Second Avenue and recently passed First Avenue. This provides the operator with an easily recognizable display of cross streets on a roadway defined by converging graphic lines 95, which includes arrows 94 to provide a clear graphic diagram to the vehicle operator as to the vehicle's location with respect to forthcoming cross streets. In the event that the area does not provide cross-street information or street addresses for a given location of the vehicle, a display is provided to the operator, indicating that such information is not available and the operator must return to the main menu and enter the highway or local point-of-interest mode for guidance. The operator can always select the current information display of Fig. 11 by actuating the back button 64 when in any of the other modes until the information is displayed or actuate the menu button and actuate cursor switches 61, 62 to align cursor 27 with current information and actuate the select switch 63 to provide the compass, temperature, time, and date information display of Fig. 11.

Fig. 5 illustrates the various operational modes described above by the actuation of the select, menu, back, scroll, and POI switches to select points of interest, select a category contained within the points of interest, identify a particular establishment in that category, and go to the point-of-interest display, which provides detailed information as to how to approach the selected point of interest. The flow diagram 100 of Figs. 22A, 22B, and 22C represents the programming of the microprocessor through the program contained in memory 31 of Fig. 4 to detect the actuation states of the various operator-actuated switches look at the data from the GPS receiver 40 and the flash memory 29 and display the resultant selected display information. The figure numbers of the display figures are included in the flow diagram 100.

Turning initially to Fig. 22A, the main menu 110 of Fig. 6 is displayed and the program looks at block 112 to determine if a highlighted entry has been selected and, if it has, whether the point of interest has been selected at block 114. If a point of interest display has been selected, the program moves to block 102 (Fig. 22B) and displays the point-of-interest menu of Fig. 7 or Fig. 8, depending on the location of the vehicle, either on a limited access highway or on a local roadway. If no entry has been selected in block 112, the program cycles through the main menu until such time as something has been selected by scrolling to and highlighting a desired entry. If no point of interest has been selected, the program detects at block 116 whether the street sign has been selected and, if not, at block 118, whether the current information has been selected. If current information has been selected, the display of Fig. 11 is presented, as shown by block 120. If street signs has been selected, the display of current address of Fig. 9 is presented as shown by block 122. If street signs is not selected and current information is, the program automatically updates from the data received from the compass, temperature sensor, and internal clock the information displayed in Fig. 11. The program then continues to detect at blocks 124 and 126 (Fig. 22B) whether or not menu or back has been selected. If not, it remains with the current display of Fig. 11.

If, at block 118, current information has not been selected, the program tests at block 128, whether the off selection has been entered and, if not, the program returns to the main menu 110. If off has been selected at block 128, the display is turned off, as indicated by block 134 (Fig. 22A), and the system is idle until such time as any switch

has been depressed, as indicated by block 136. When this occurs, the program returns to the main menu block 110 of Fig. 22A.

If a point of interest display has been actuated as indicated by an affirmative decision in block 114, the program moves to block 102 (Fig. 22B), displaying either the Fig. 7 or Fig. 8 menu, as indicated above. If a point of interest is not selected as indicated by a no decision in block 104, the program continues to look to see if menu or back has been selected at 130, 132 and, if not, cycles through the loop, including blocks 102 and 104, until such time as either a lodging point-of-interest key 67 (Fig. 2) has been actuated as indicated by block 105, a gas point-of-interest key 65 (Fig. 2) has been actuated, or a food point-of-interest key 66 has been selected as indicated by blocks 105-107, respectively, in Fig. 22B. If one of these categories has been selected as indicated by block 108, the point of interest distance, direction, and location of Fig. 15 is displayed. The program then detects whether a menu or back select switches have been actuated at blocks 140 and 142 and, if so, the program returns to either the main menu or displays the point-of-interest menu, as indicated in block 102.

If "street signs" is selected as indicated in block 116 (Fig. 22A) and the address of Fig. 9 is displayed, the program tests to determine if a menu select or back select switch has been actuated as indicated by blocks 144 and 146 (Fig. 22B). If the menu select switch has been actuated, the program returns to the main menu of block 110. If not and the back select switch has been actuated by an affirmative decision in block 142, the program also returns to the main menu. If the back select switch has not been actuated, the program tests to determine if the down arrow at block 148 has been actuated. If it has, the program displays the street sign mode of Fig. 10, as shown at block 150 and continues to display that until such time as either the menu select switch at block 152 has been actuated or the back select switch at block 154 has been actuated or the up arrow as indicated by block 156 has been actuated. If the down arrow select switch has not been actuated at block 148, the program returns to the current address display as shown at block 122. If the arrow up select switch has been actuated as indicated by an affirmative decision at block 156 or the back select switch activated, the program returns to the current address display of Fig. 9 indicated at block 122.

Thus, the flow diagram of the program of Figs. 22A-22C illustrates the operation performed by the program during a sequence of operation through the menu as shown

also in Fig. 5, as well as at the same time updating the location information from the GPS receiver and selected point-of-interest information, including distance to and/or direction to the selected point-of-interest information being displayed.

It will become apparent to those skilled in the art that various modifications to the preferred embodiment of the invention as described herein can be made without departing from the spirit or scope of the invention as defined by the appended claims.

The invention claimed is:

1. A vehicle display system comprising:
 - a current location detector for providing data representing the vehicle's current position;
 - a database of road network information including street names and addresses along the streets thereon;
 - a microprocessor coupled to said detector and to said database for providing display output signals representing location information as the vehicle moves along a street;
 - a display coupled to said microprocessor for displaying information selected by an operator; and
 - at least one operator-actuated switch coupled to said microprocessor to allow the operator to select for individual display one of said addresses on a street on which the vehicle is traveling and cross-streets ahead and behind the vehicle.
2. The vehicle display system as defined in claim 1 wherein said detector is a GPS receiver.
3. The vehicle display system as defined in claim 2 wherein said display of addresses further includes a display of the street name on which the vehicle is traveling.
4. The vehicle display system as defined in claim 2 wherein said display of cross streets includes graphic lines depicting sides of a roadway and the cross streets are positioned between said lines.
5. The vehicle display system as defined in claim 4 wherein said display of cross streets includes at least one arrow aligned with respect to the displayed cross streets at a position indicating the position of the vehicle with respect to said cross streets.
6. The vehicle display system as defined in claim 5 wherein said display displays two cross streets ahead of the vehicle.

7. The vehicle display system as defined in claim 6 wherein said display includes two arrows with an arrow positioned adjacent each graphic line representing a side of a roadway.
8. The vehicle display system as defined in claim 1 wherein said database further includes points of interest and wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest when on a highway and said display displays the distance and direction to said selected point of interest and after exiting a highway said display selectively displays detailed information regarding a selected point of interest.
9. The vehicle display system as defined in claim 8 wherein said database has data sets layered thereon according to road network information and point-of-interest information such that said memory can be updated separately at different time intervals for separately updating the road network information and point-of-interest information.
10. The vehicle display system as defined in claim 1 wherein said database has data sets layered thereon according to road network information and point-of-interest information such that said memory can be updated separately at different time intervals for separately updating the road network information and point-of-interest information.
11. The vehicle display system as defined in claim 1 wherein said database further includes points of interest and wherein said operator-actuated switch permits the operator to selectively display the exits on a highway on which the vehicle is traveling, wherein said microprocessor is programmed to respond to operator input signals from said switch to provide a scroll-forward display of upcoming highway exits and for displaying points of interest accessible at such highway exits.
12. The system as defined in claim 1 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest and said display selectively displays detailed information regarding a selected point of interest.

13. The system as defined in claim 1 and further including an electronic compass coupled to said display.
14. The system as defined in claim 1 and further including an outside temperature sensor coupled to said display.
15. The system as defined in claim 1 and further including a trip computer coupled to said display.

1/13

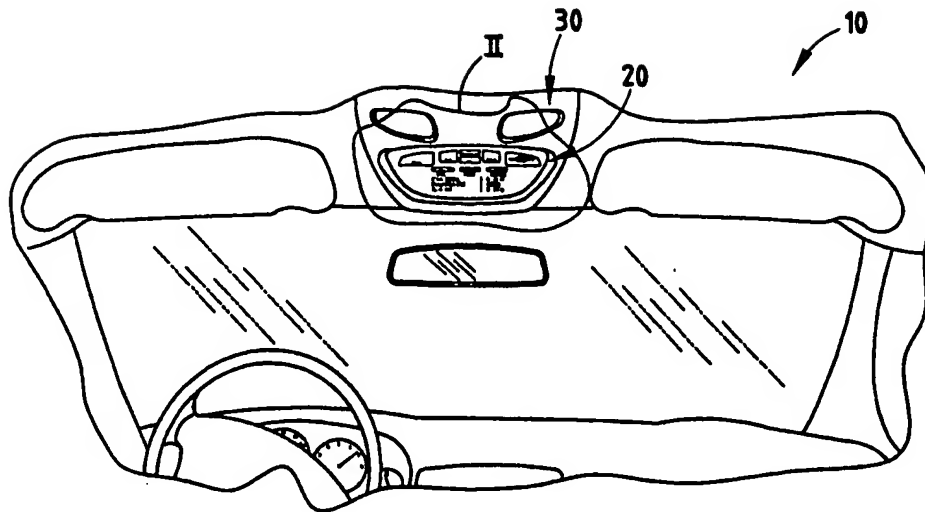


FIG. 1

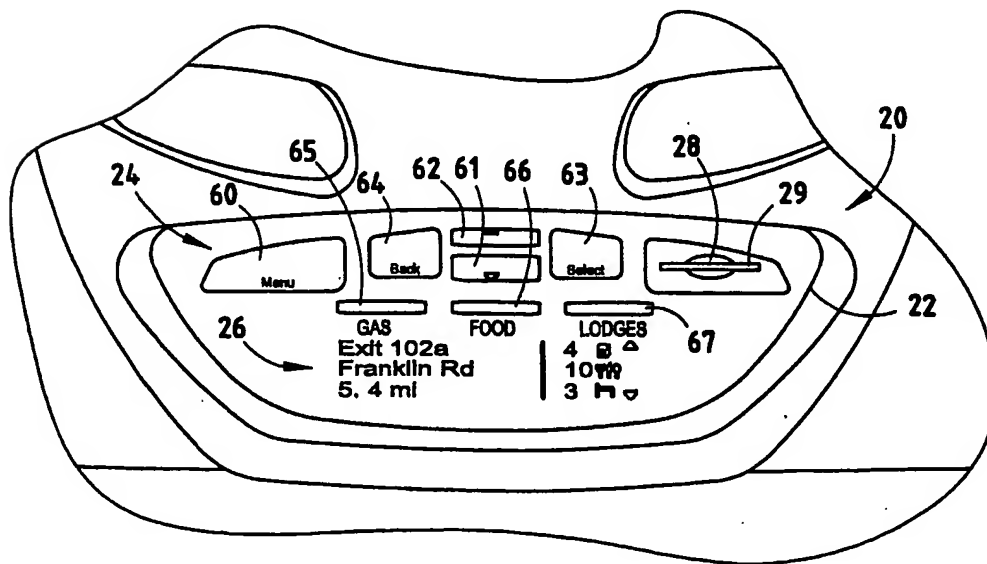


FIG. 2

2/13

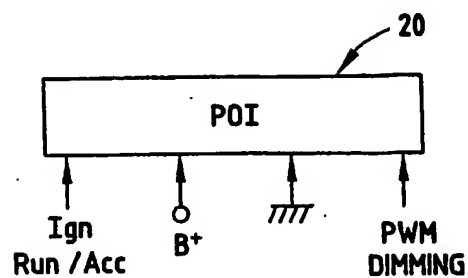


FIG. 3

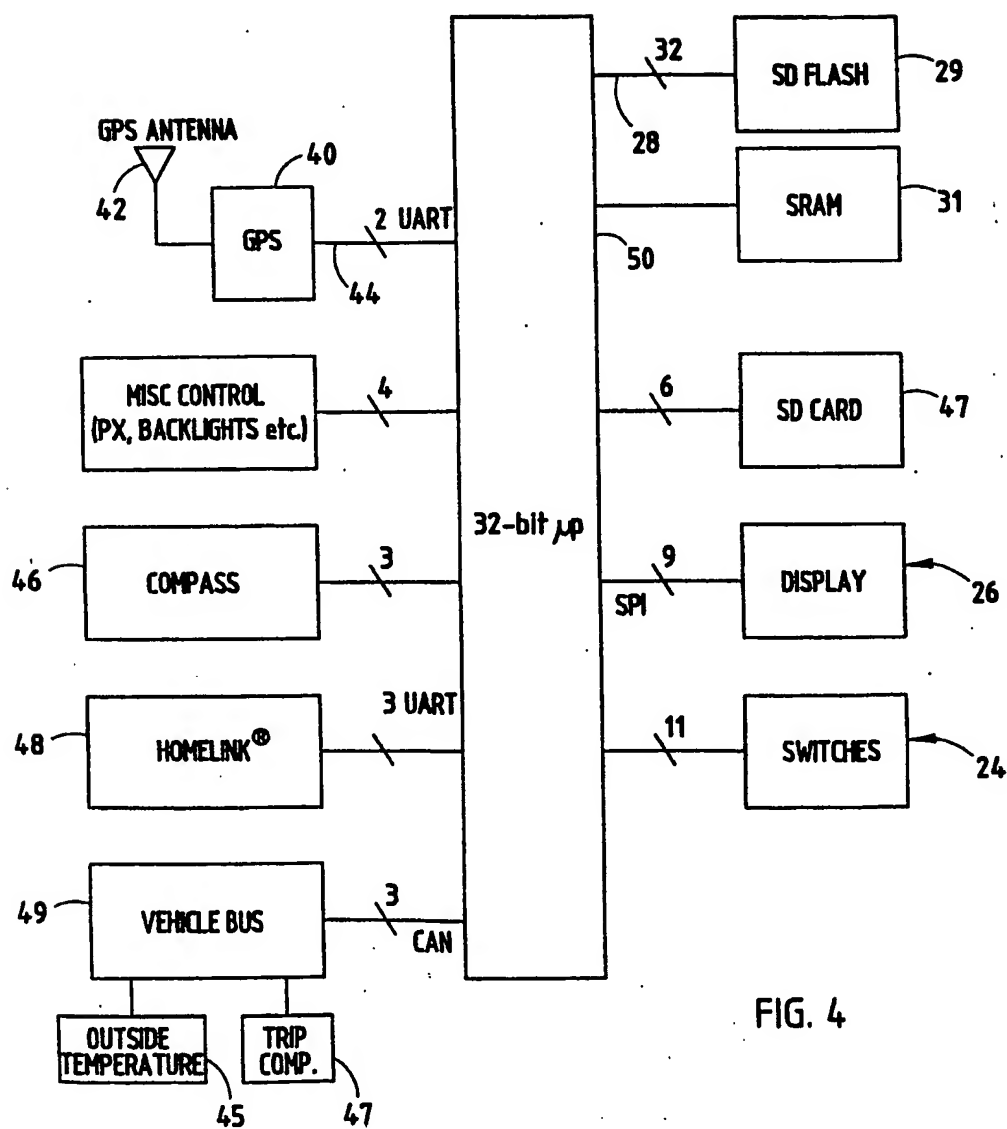


FIG. 4

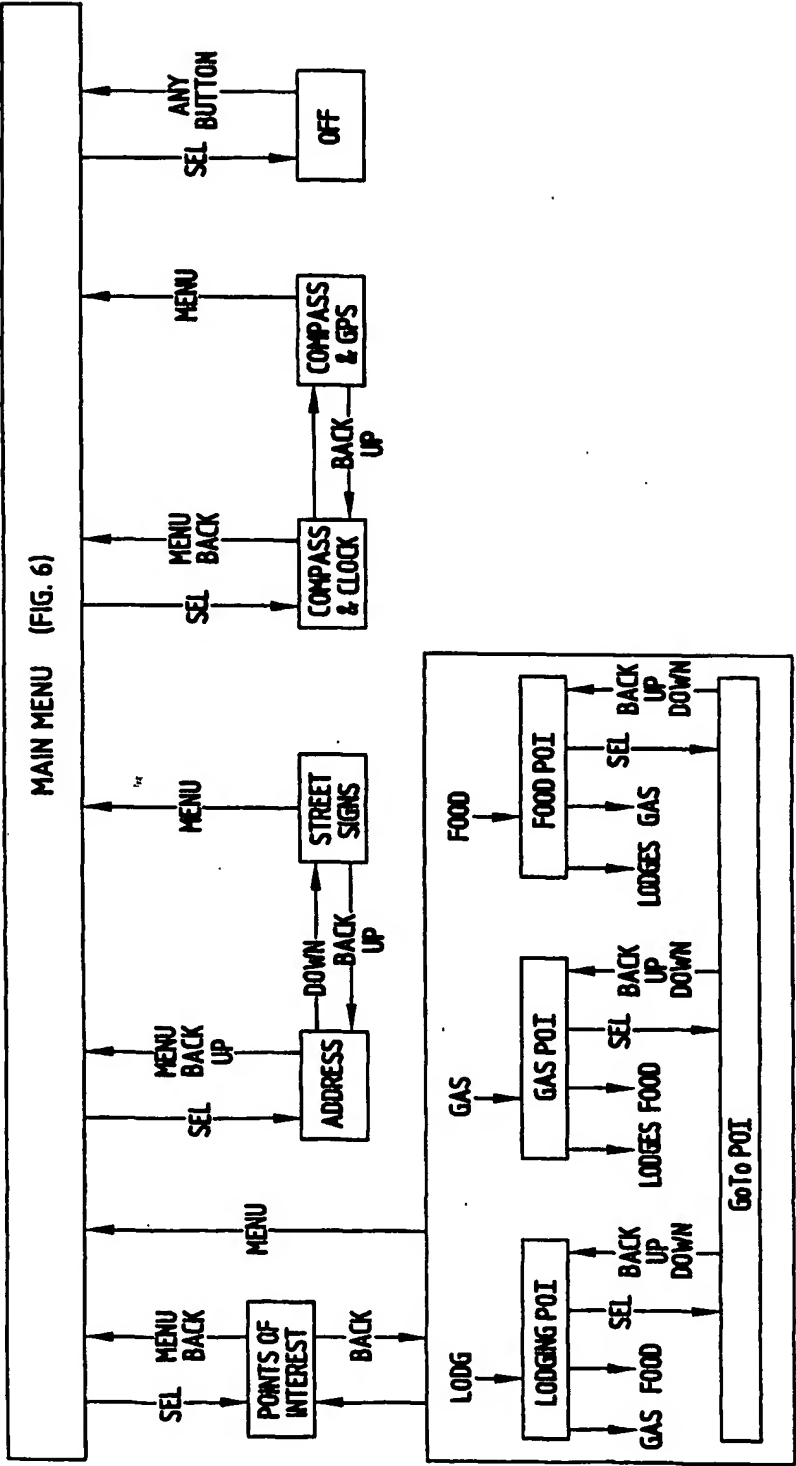


FIG. 5

4/13

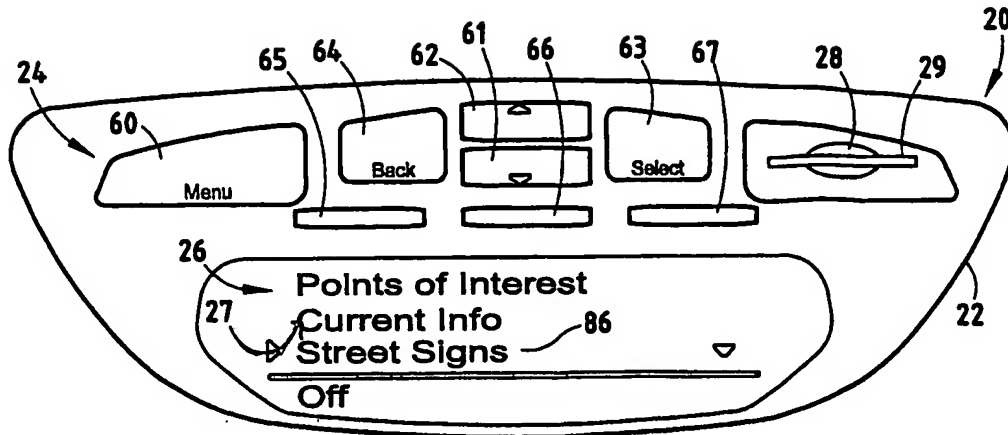


FIG. 6

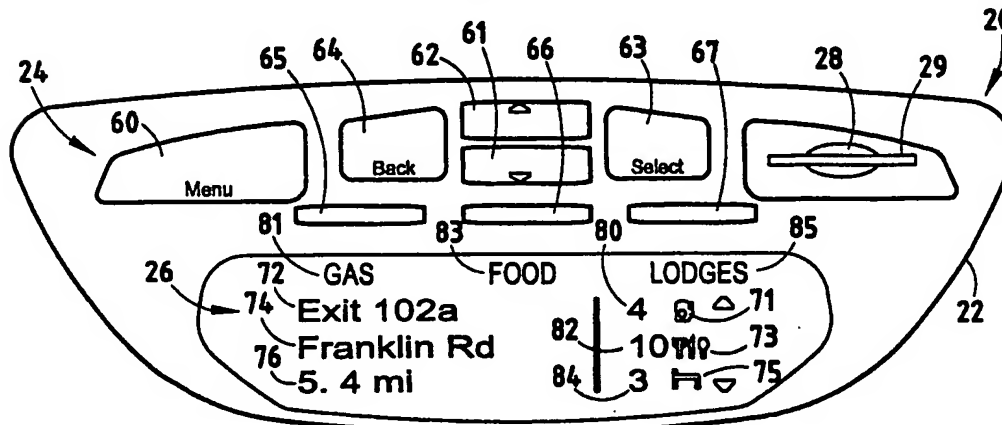


FIG. 7

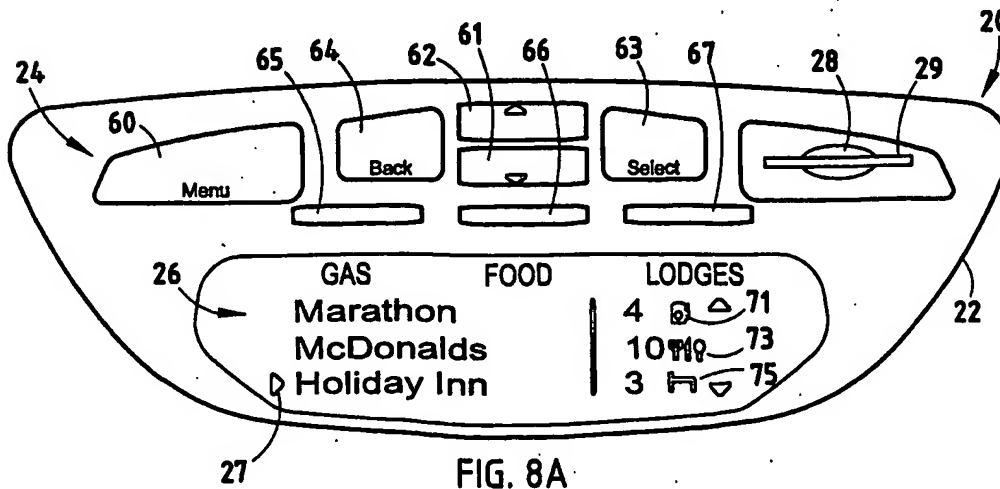


FIG. 8A

5/13

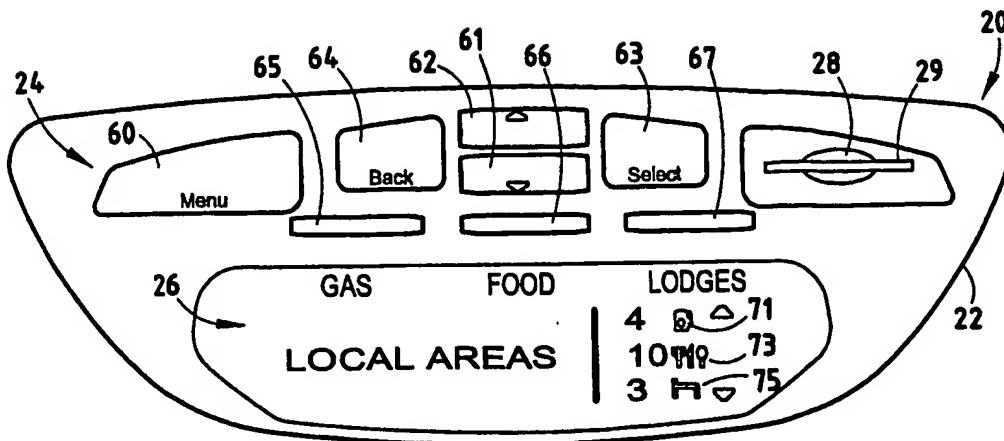


FIG. 8B

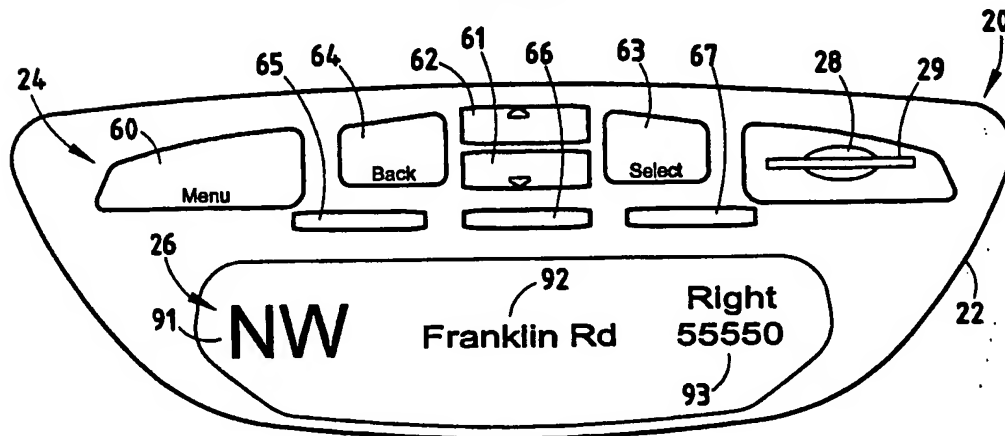


FIG. 9

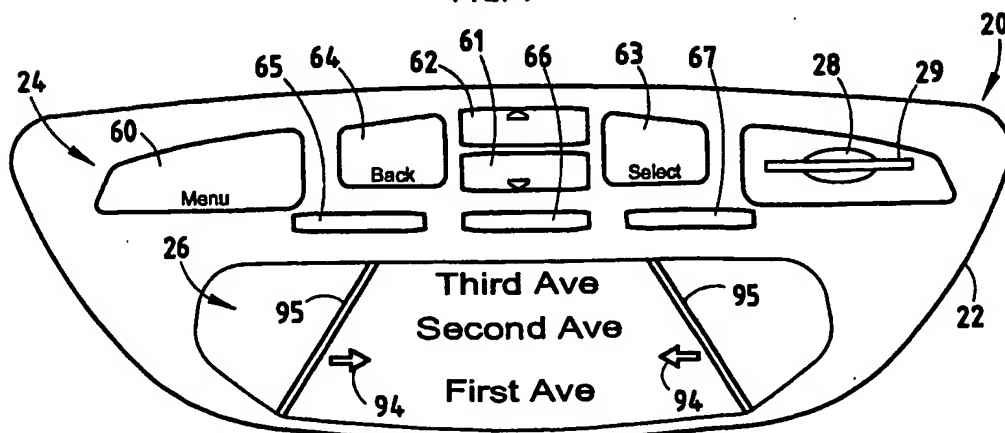


FIG. 10

6/13

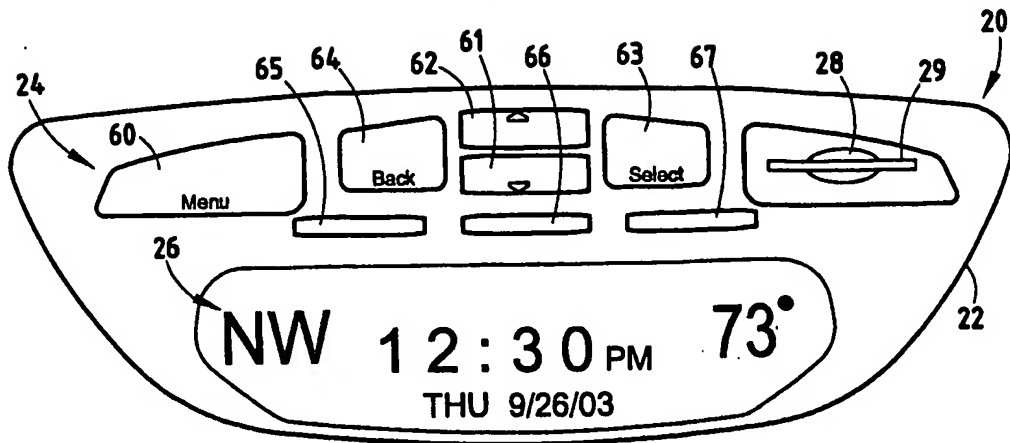


FIG. 11

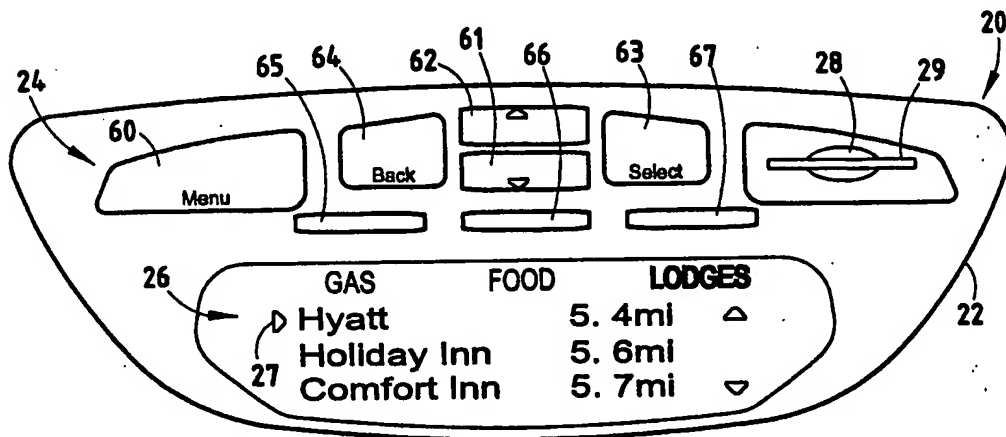


FIG. 12

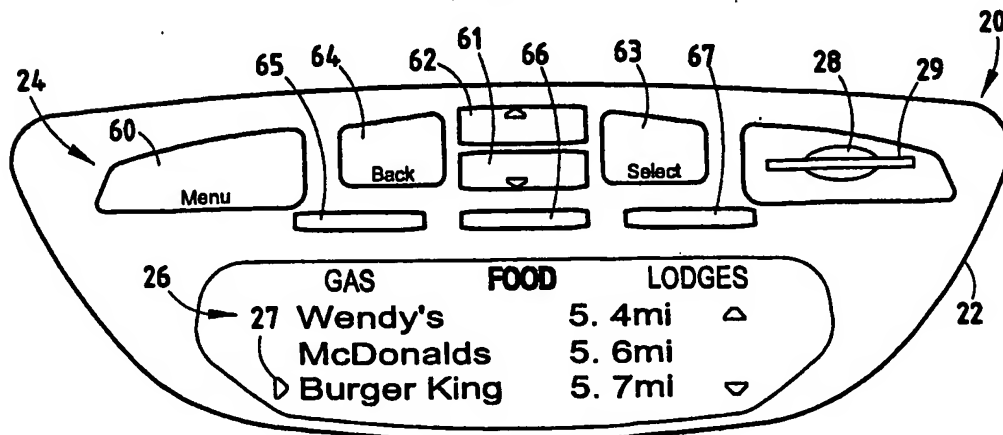


FIG. 13

7/13

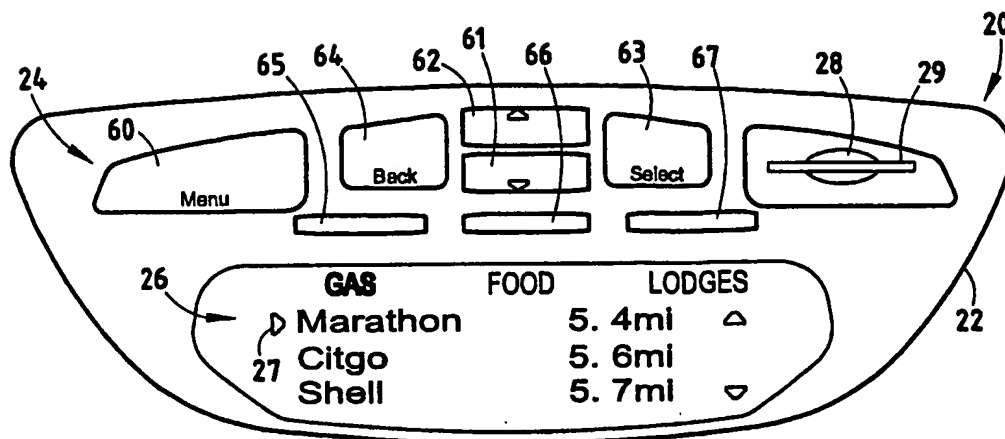


FIG. 14

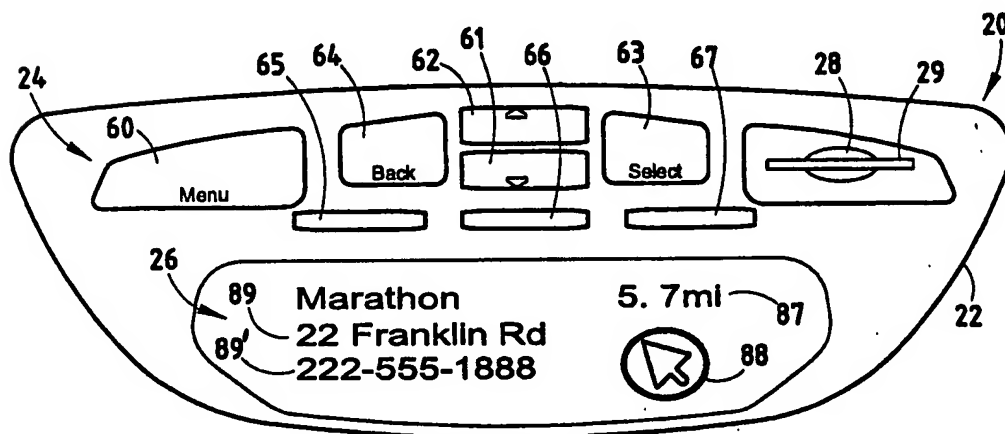


FIG. 15

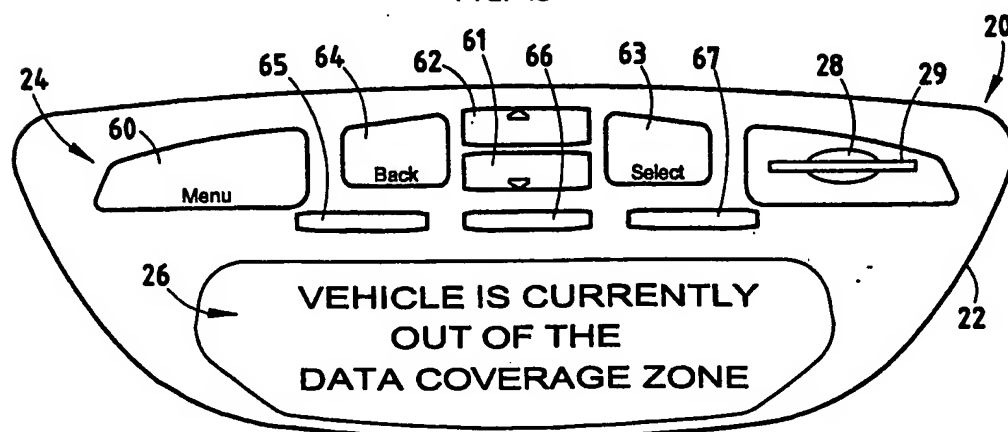


FIG. 16

8/13

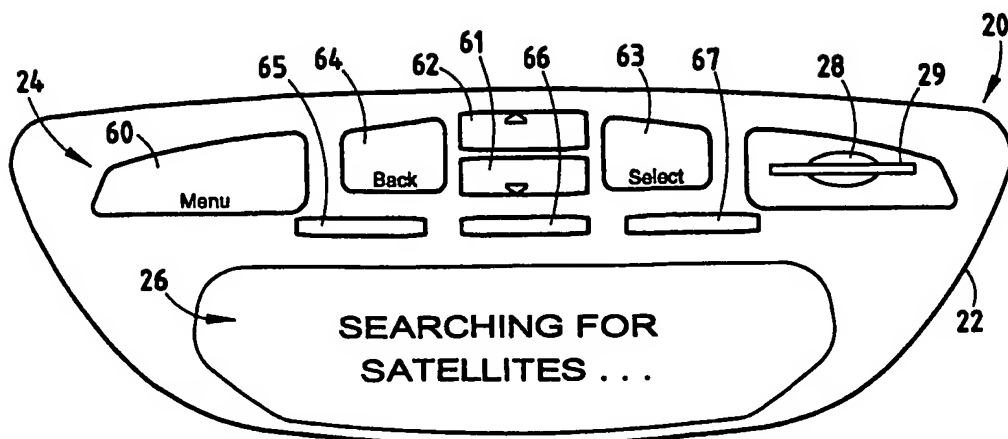


FIG. 17

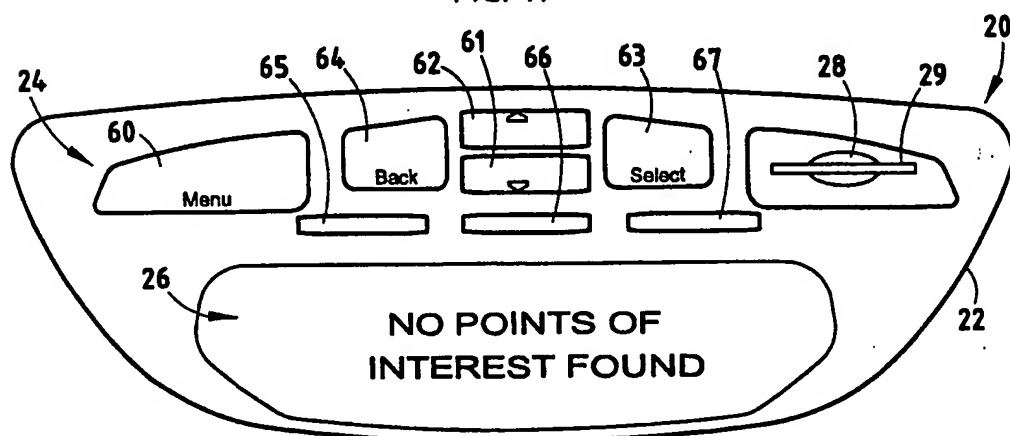


FIG. 18

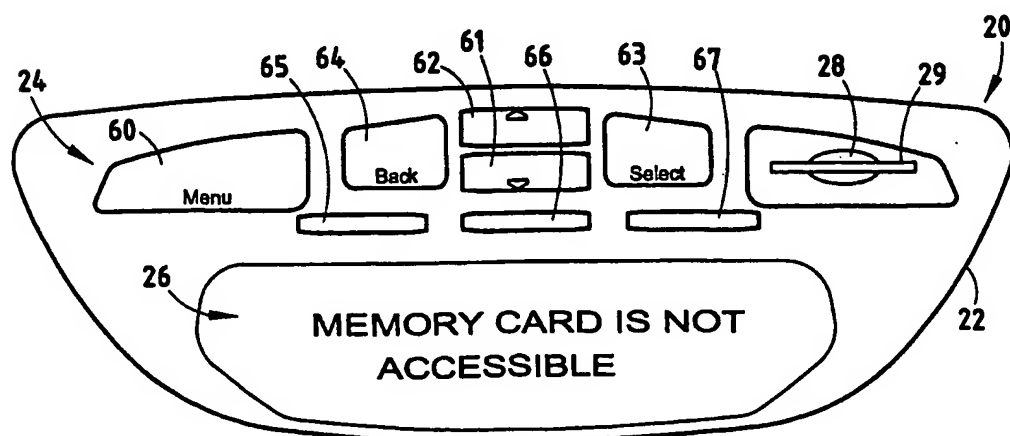


FIG. 19

9/13

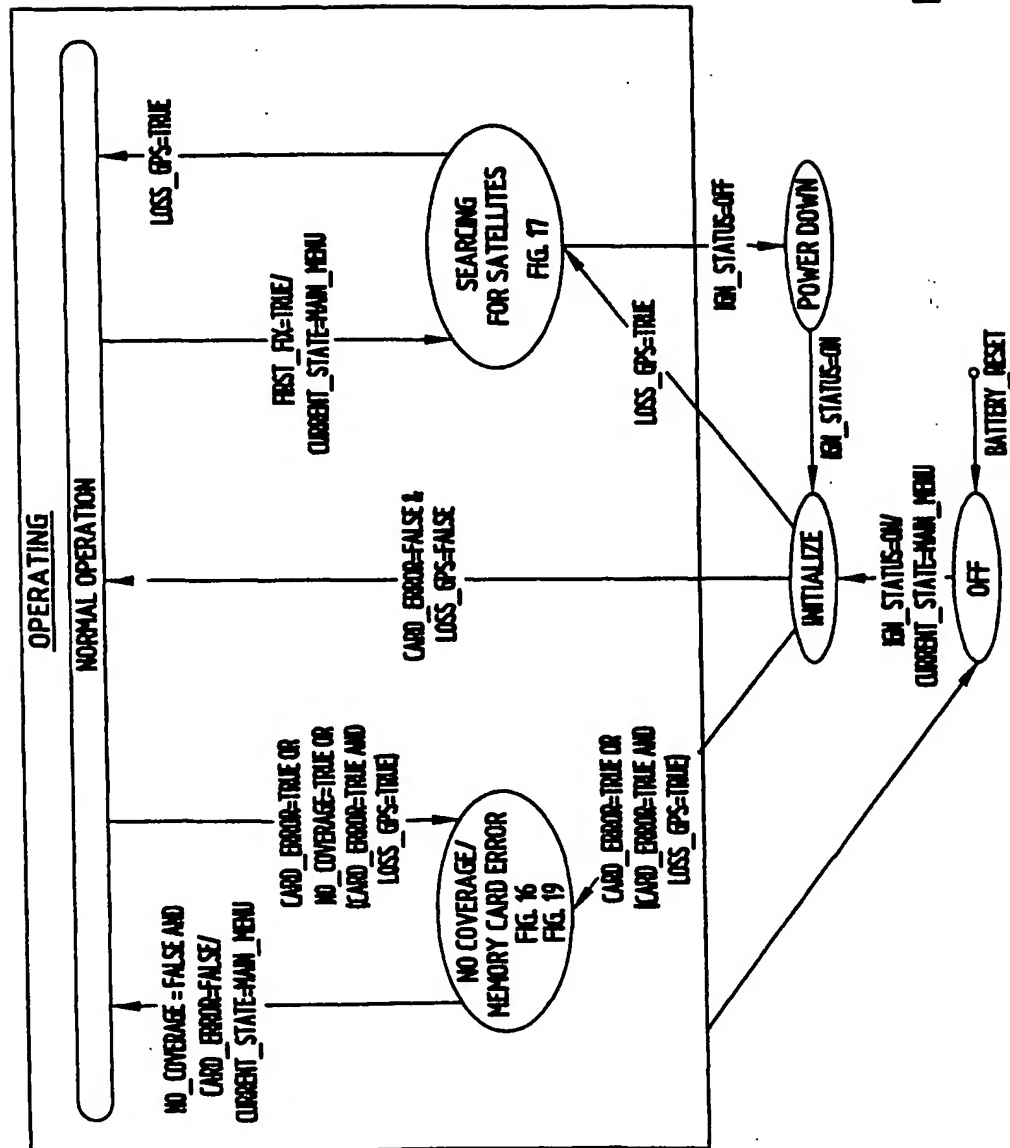


FIG. 20

10/13

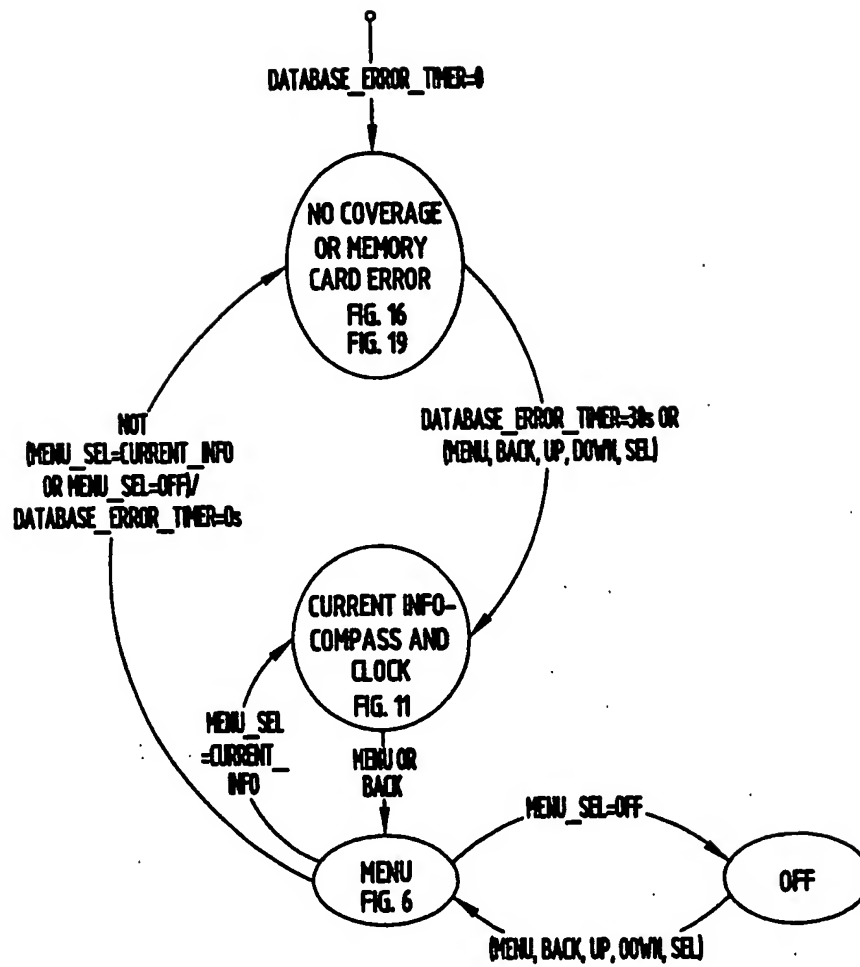


FIG. 21

11/13

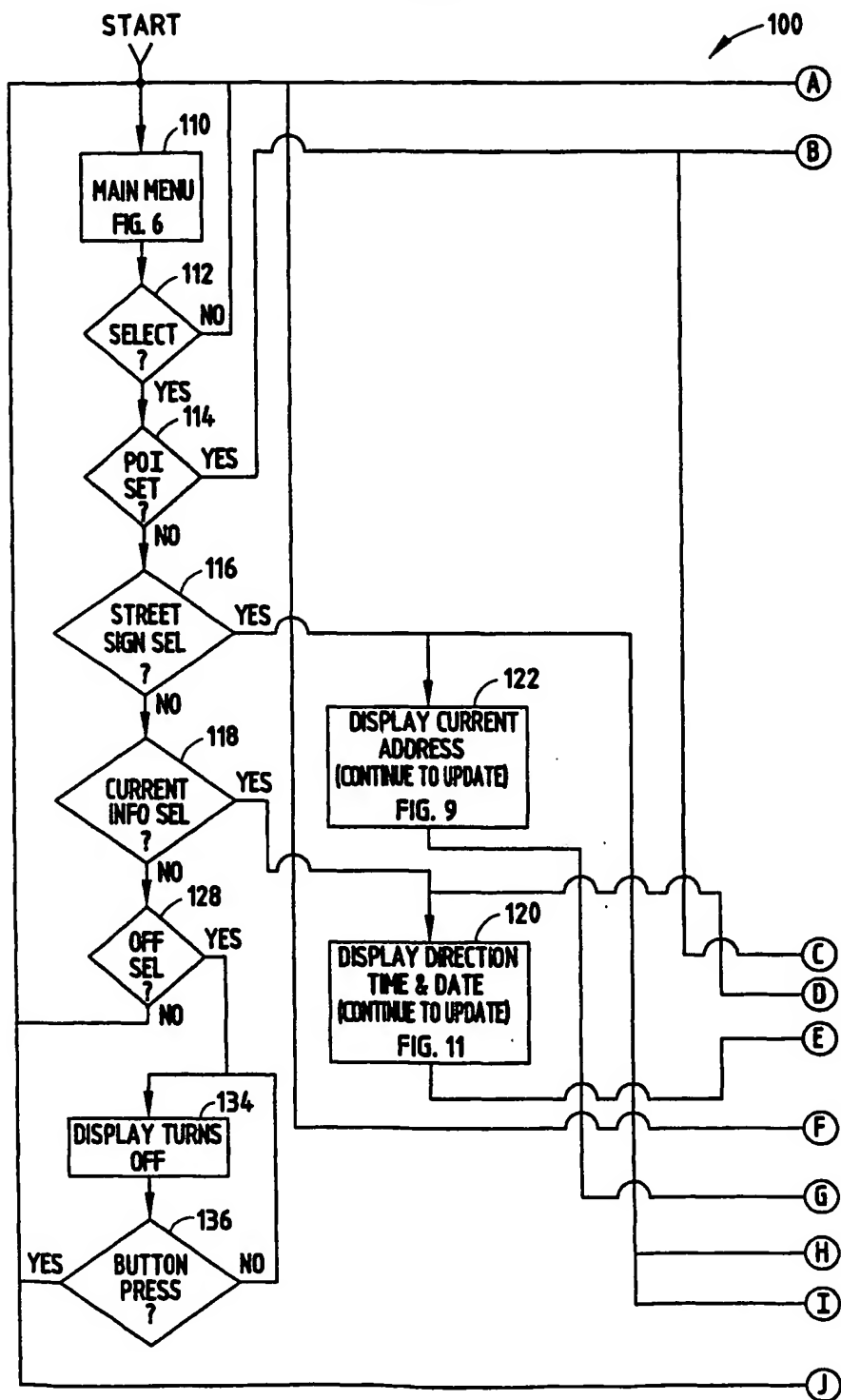


FIG. 22A

12/13

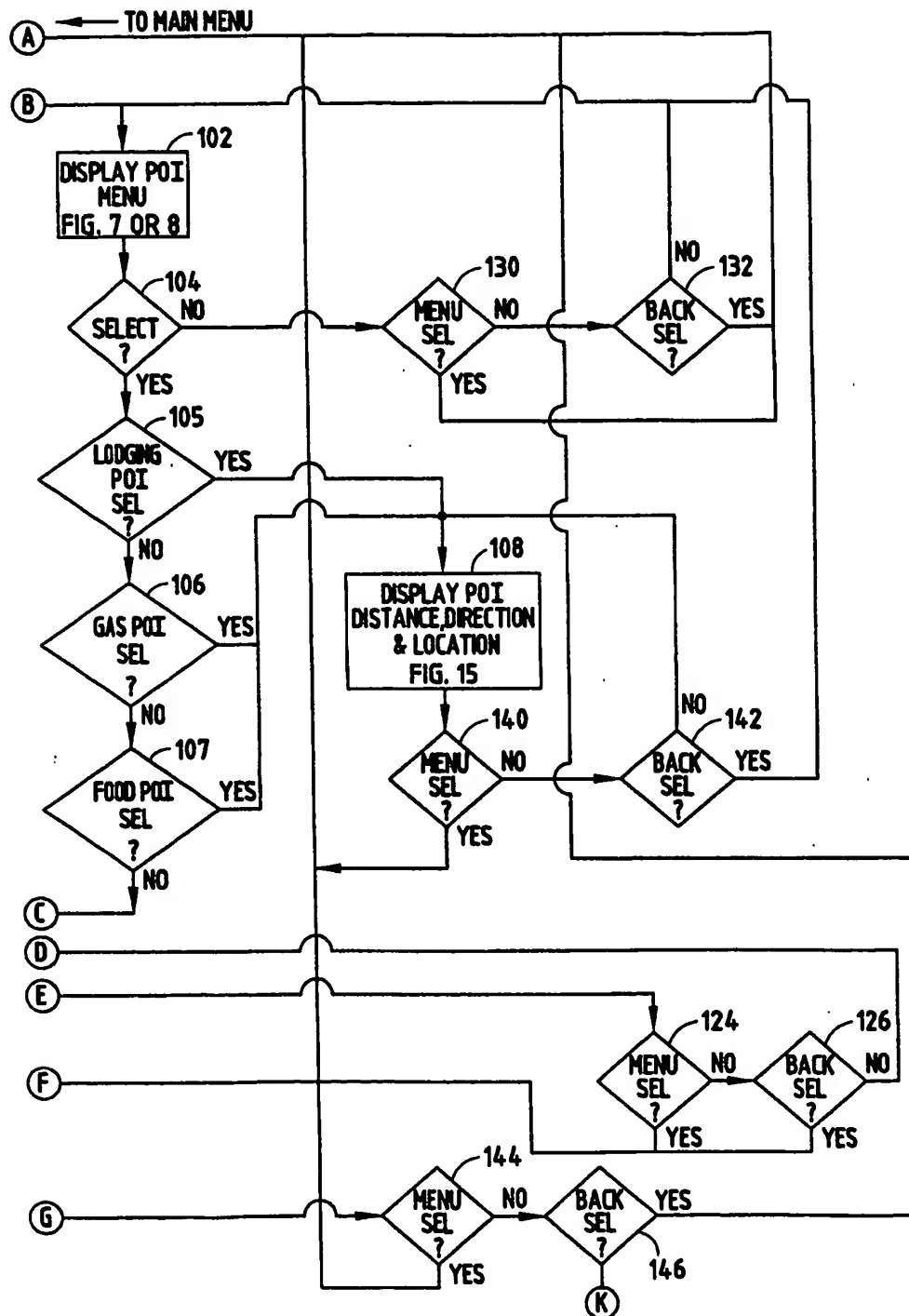


FIG. 22B

13/13

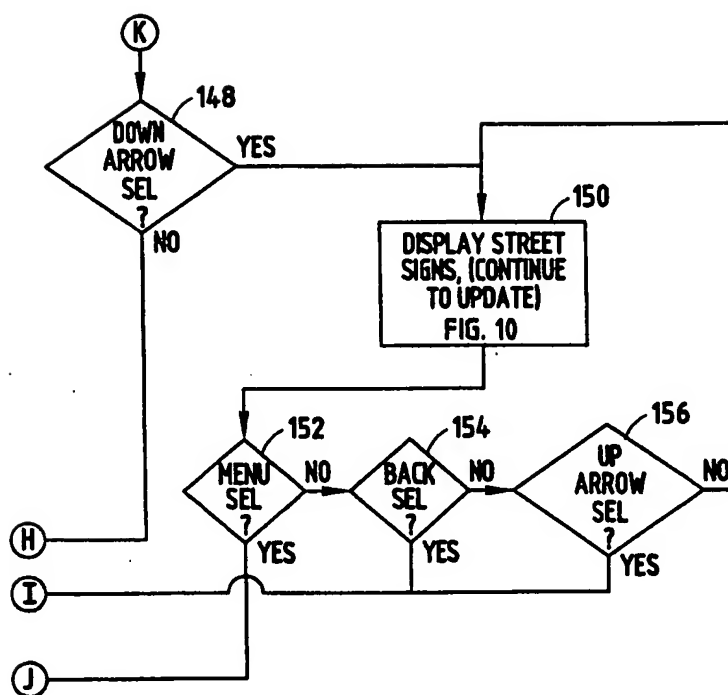


FIG. 22C

POINT-OF-INTEREST DISPLAY SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a display system for a vehicle and particularly to one which provides a display of selected names of points of interest arranged by category and elemental directions to a selected point of interest. One embodiment provides a graphic display of cross-streets or addresses as the vehicle travels along a local roadway.

There exist numerous vehicle navigation systems which provide graphic map displays, which allow the vehicle operator, through significant manipulation of controls, to plan a travel route and obtain information about arrival destinations, typically by address. Some systems provide navigation control through the use of voice recognition programs and control circuits. All of these systems are relatively expensive, complicated and difficult for a vehicle operator to utilize, particularly when preoccupied with surrounding traffic in congested areas. Some suggested simplified navigation systems allow the vehicle operator to either identify his or her current location by street address and forthcoming intersection information, as well as basic points of interest information. Such systems are relatively inexpensive but do not provide the operator with the flexibility of providing points-of-interest information in a user-friendly format nor additional desirable features, such as easily accessible alternate displays of forthcoming highway exits, street intersections, or street addresses when traveling on a local street.

Thus, there remains a need for a display system for a vehicle which is relatively inexpensive and is user-friendly to operate using a minimum number of intuitive controls. Such a system needs to provide desirable features, such as points of interest in selected categories which can be easily accessed with minimal operator intervention and yet provide the operator with sufficient information to be able to locate and travel to such points-of-interest.

SUMMARY OF THE INVENTION

The system of the present invention satisfies this need by providing a point-of-interest display system in which an updateable database includes road network information, which can be updated at relatively infrequent time intervals, and point-of-

interest information which can be user-updated at more frequent intervals, as new points of interest become available. In a preferred embodiment of the invention, the database is carried on the vehicle in the form of a flashcard or other removable memory device or loaded into flash memory residing in the vehicle via a data communication system. The database interfaces with a microprocessor on the vehicle which receives data from a current position detector, such as a GPS receiver, providing the system with current vehicle location and direction of travel information. A display provides the operator textural and elemental graphic display information, and one or more control switches are positioned in an easily accessible location within the vehicle such that the operator, by scrolling through displayed highway exits, can select categories of points of interest, and points of interest within a category upon the actuation of a minimal number of switches in an intuitive sequence.

In one embodiment of the invention, two modes of operation provide point-of-interest information either while the vehicle is traveling on a limited access highway or, once the vehicle has exited the highway, provides more specific point-of-interest directions. In another embodiment of the invention, the operator can, when on a local road, select the textural display of forthcoming and past intersecting streets, which is updated as the vehicle travels along the roadway. In yet another embodiment of the invention, the navigation system provides a display of the street addresses on which the vehicle is traveling and increments, decrements, or otherwise updates the address as the vehicle moves. In a preferred embodiment of the invention, each of these features are incorporated in a system which allows selection between the features, either manually or automatically as the vehicle moves between a limited access highway and a local roadway.

These and other features, objects and advantages of the present invention will become apparent upon reading the following description thereof together with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a fragmentary perspective view of a vehicle having a point-of-interest display system embodying the present invention;

Fig. 2 is an enlarged fragmentary view of the system shown in Fig. 1;

Fig. 3 is a block electrical diagram showing one interface connection of the system to the vehicle power system;

Fig. 4 is a block electrical circuit diagram of the point-of-interest system including its major components;

5 Fig. 5 is a flow diagram showing the menu operation for operation of the system shown in Figs. 1-4;

Fig. 6 is the display screen for the main menu;

Fig. 7 is the display screen illustrating the information displayed to the vehicle operator when in a highway point-of-interest mode of operation;

10 Figs. 8A and 8B are alternate display screens illustrating the information displayed to the vehicle operator when in a local point-of-interest mode of operation;

Fig. 9 is the display screen illustrating the information displayed to the vehicle operator when in a street-address mode of operation;

15 Fig. 10 is the display screen illustrating the information displayed to the vehicle operator when in a street-sign or cross-street mode of operation;

Fig. 11 is the display screen illustrating the information displayed to the vehicle operator when in a current-information mode of operation;

20 Fig. 12 is the display screen illustrating the information displayed to the vehicle operator when the lodging category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 13 is the display screen illustrating the information displayed to the vehicle operator when the food category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

25 Fig. 14 is the display screen illustrating the information displayed to the vehicle operator when the gas category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 15 is the display screen illustrating the information displayed to the vehicle operator when a particular point of interest in the highway mode has been selected;

30 Fig. 16 is the display screen illustrating the information displayed to the vehicle operator when the vehicle is out of the coverage zone;

Fig. 17 is the display screen illustrating the information displayed to the vehicle operator during initial start up when the GPS receiver is looking for satellites;

Fig. 18 is the display screen illustrating the information displayed to the vehicle operator when no point of interest was found at a selected exit;

Fig. 19 is the display screen illustrating the information displayed to the vehicle operator in the event a memory card has not been inserted into the circuit;

5 Fig. 20 is a flow diagram of the operation of the system during start up and shut down;

Fig. 21 is a flow diagram of the normal operation mode of the system; and

Figs. 22A, 22B, and 22C are a detailed flow diagram of the programming of the system during operation.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring initially to Fig. 1, there is shown a vehicle 10, such as an automobile, van, sports utility vehicle, truck, or the like, which incorporates a point-of-interest display system of one embodiment of the present invention. The point-of-interest display system 20 is mounted in one embodiment in an overhead console 30, although it can be mounted at any conveniently accessible location within easy reach of the vehicle operator, such as in the instrument panel. The point-of-interest system includes a switch group 24 and a display section 26, shown in detail in Fig. 2. The point-of-interest system can be mounted within a housing 22, which includes both the display 26 and switch section 24, as well as a memory card slot 28 for receiving a removable memory card 29, such as a flashcard on which the point-of-interest and road network data is programmed. Alternatively, separate mounting of the components is possible.

The memory card 29 typically will be at least a 128 meg card, although 256 or 512 meg cards may be preferred. The memory card is removable from slot 28, such that data thereon, including road network information and point-of-interest (POI) information, can be separately programmed in layers thereon, such that the road network and POI data can be refreshed at different, periodic intervals. Memory card 29 includes nonvolatile memory and contains a handshake code to communicate with a microprocessor 50 (Fig. 4) of the system, so the microprocessor can read data on the memory card 29. The system, as seen in Fig. 4, also includes a programmable SRAM memory 31, which contains the program for the sequential operation of the system, as shown in Fig. 5. The flow diagram for the program is shown in Figs. 22A, 22B, and 22C, described below. In one embodiment memory card 29 can be obtained from a car

dealer with an update subscription service for refreshing the data on the card either annually, in the case of road network information, or more frequently as new points of interest may become available, such as, for example, on a monthly basis. Alternatively, the user may subscribe to a web site providing download information for refreshing the data on memory card 29 on a personal computer if desired. Card 29 may also be updated through other means. Typically, the memory card will have data sufficient for a regional area in which the vehicle normally travels and will contain points of interest according to categories, such as gas, food, and lodging, as well as all the major (*i.e.*, limited access) and secondary road identifications and street addresses for secondary roads.

The map database is composed of at least two layers, at least one of which includes data like points of interest that change frequently. It is, therefore, desirable to update this information frequently. Another layer or layers of data contain information like the road network that may be undated less frequently. The data layers are linked and each layer may be updated either independently or in combination with other layers. This allows the consumer to obtain updated information without excessive download time when refreshing the data through the Internet, since the update can be limited to the part of the data that changes frequently.

Each layer is contained within a single file on the flashcard 29 for a given geographical area. Every POI record, whether for highway or local coverage, references a street name record in the road network file. This reference is stored in the POI file as an index into the street name table in the road network file.

As the latest POI information is released and compiled, every POI file that is created is associated with the latest road network file available. In addition, any new points of interest that are associated with roads that are not yet compiled into the latest road network file are added to the POI file but are flagged as being without a street name. All other POI attributes, such as telephone number, latitude/longitude and name, are still available in this case. Details of some aspects of the programming of they system to provide the various modes of operation are disclosed in Application No. 60/419,934, entitled **SYSTEM AND METHOD FOR DISPLAYING VEHICLE LOCATION AND POINT OF INTEREST INFORMATION**, the disclosure of which is incorporated herein by reference and in connection with the flow diagrams of Figs. 22A-22C.

The system, as best seen in Fig. 4, includes a current location detection device, such as GPS receiver 40, having an antenna 42 for receiving global positioning satellite signals from multiple satellites and providing current location data to one or more microprocessor(s) 50, which can be a Motorola MC9512DJ64 or its equivalent, through a universal asynchronous receiver/transmitter connection 44. Other current location detection sources of data, such as a Loran receiver, gyro compass, or dead reckoning information sources, may also be employed but a GPS receiver represents the current best mode of receiving such data. The microprocessor receives vehicle location data from the GPS receiver and point-of-interest and road network data from the flashcard 29, which is inserted into slot 28 and coupled to the one or more microprocessor(s) 50. An SRAM memory 31 is also coupled to the microprocessor(s) 50 and contains the system program. The microprocessor is also coupled to one or more operator-actuated switches in the switch section 24 and to a display 26, such as a dot matrix display, for selectively displaying information, such as shown in Figs. 2 and 6-19, to the vehicle operator.

The point-of-interest circuit 20 is coupled to the vehicle power system, as shown in Fig. 3, and includes an ignition input for receiving power when the ignition is either in the run or accessory position, a B+ input drawing a maximum of 300 micro amps when the system is deactivated, a coupling to the system ground and a pulse width modulated dimming input circuit for dimming the back-lighted switches of the switch bank 24 and the dot matrix display 26 based upon the operator's selected lighting level for instrument displays. In some installations, the system could be coupled directly to the vehicle's power supply through the ignition switch and vehicle ground. In another, dimming information is received from the vehicle bus. The microprocessor 50 is also coupled to other vehicle systems, such as a vehicle compass 46 for displaying in the normal mode of operation, when the point-of-interest system is not being employed, the outside temperature, the compass heading, the time and date information, as seen in Fig. 11. The microprocessor may also be coupled to and employed for other vehicle control functions, such as a Homelink® brand programmable transmitter 48, and may be coupled to the vehicle bus 49 for receiving PWM dimming information, ignition run, accessory information, and the like. An outside temperature sensor and circuit 45 may be coupled to the microprocessor(s) 50 or the vehicle bus 49, as shown in Fig. 4, to provide the

temperature display as seen in Fig. 11. Also, a trip computer 47 may be coupled to the microprocessor(s) 50 or to the vehicle bus 49, as shown in Fig. 4, to provide typical trip functions, such as a resettable odometer, fuel consumption, average speed, and estimated time of arrival information, which can be displayed on display 26.

5 The user-friendly, intuitive switch controls 24 are seen in Fig. 2 and incorporate a menu switch 60, a scroll forward switch 61, a scroll back switch 62, which are physically positioned on the console pointing in a forward and rearward position, respectively, with arrows thereon so as to intuitively indicate to the vehicle operator that the actuation of the scroll switches advances the display to a point of interest or highway exit forward or behind the vehicle. The switch controls 24 also includes a select switch 10 63 for selecting a given entry highlighted by the movement of a display cursor 27 (Fig. 8) through actuation of scroll switches 61 and 62 and a back switch 64, which allows the operator to move back one entry. Additionally, keys 65, 66, and 67 are provided and are aligned with display icons showing "gas", "food", and "lodges", respectively, as 15 seen in Fig. 2. When the system is employed with a HomeLink® brand trainable transmitter, the switches can, when the POI system is off (Fig. 6), provide the dual function of operating any one of the three programmed transmitting frequencies and codes for up to three different garage doors, home appliances, security gates, or the like.

 The operation of the system seen in Figs. 1-4 is best understood by reference to 20 the program flow diagram of Figs. 22A, 22B, and 22C together with the menu diagram with Fig. 5 in connection with the displayed information, as seen in Figs. 2 and 6-19. Initially, when this system is powered up, as shown in Fig. 20, the system searches for satellites and displays a message, as shown by Fig. 17. In the event a memory card or flashcard 29 has not been inserted, the system displays the message shown in Fig. 19, 25 either that the "memory card is not inserted" or the message shown in Fig. 16, that "the vehicle is out of the current data coverage zone." Assuming the memory card is in place and the vehicle is in the data coverage zone and satellite signals have been received, the display screen of Fig. 6 is displayed allowing the operator the option of selecting points of interest (POI) by scrolling, utilizing switches 61 and 62, current information which provides any combination of the compass heading, time, date, and/or outside 30 temperature information of Fig. 11 or trip computer information (not shown). The operator may also select the street sign selection showing either the address of a street on

which the vehicle is traveling, if on a secondary road, as shown by Fig. 9, or, if the scroll button is advanced and street signs has previously been selected, to the street sign display of Fig. 10.

5 Assuming the vehicle is on a limited access highway and the operator has selected "points of interest" by scrolling to move the cursor 27, shown in Fig. 6, to the "points of interest" selection, the operator enters select by actuating switch 63, and the highway point-of-interest mode, as shown in Figs. 2 and 7, is displayed on display 26. Such display provides information as to points of interest according to categories of gas, food, or lodging, which are displayed as shown by display icons 71, 73, and 75 in Figs. 10 2 and 7. Display 26 also displays the forthcoming exit which the vehicle is approaching, as indicated by display area 72 (Fig. 7), the name of the street associated wit the exit, as indicated by display element 74, and the distance to the exit, as shown by display element 76. To the left of display icons 71, 73, and 75 is a numerical display 80 for indicating the number of gasoline stations available at that exit (*i.e.*, 4 for exit 102a), a 15 numerical display 82 indicating the number of restaurants available at that exit (*i.e.*, 10), and a numerical display 84 indicating the number of lodges or sleeping accommodations available at that exit (*i.e.*, 3). By actuating scroll switches 61 or 62, the operator can scroll forward to display, for example, the information available at the next exit (No. 20 103, for example) or the previous exit (No. 101, for example) if at exit 102 a desired POI is not available. Thus, while in the highway POI mode, the vehicle operator can look ahead or behind for points of interest and, as discussed below, select and review available points of interest at a selected exit. This enables the operator to find, for example, a favorite restaurant while traveling when meal time is approaching.

25 As the vehicle travels along the highway, the operator can actuate any one of the three keys 65, 66, or 67 aligned above the display 81 of "gas", display 83 of "food", or display 85 of "lodges", respectively, to select details of the establishments in the available categories at a selected exit. Thus, if the gas key 65 is actuated, the display of Fig. 14 appears, and the "gas" icon 81 is illuminated. The display of Fig. 14 provides three service stations available at the selected exit and their distance. A similar display 30 presentation for restaurants is shown in Fig. 13 and for lodging is shown in Fig. 12.

The operator then can scroll to the desired establishment, such as a Marathon station, as shown in Fig. 14, by actuation of switches 61 and 62 and select the

establishment aligned with the cursor 27 to be presented with a more detailed route to point-of-interest display, as shown in Fig. 15. In Fig. 15, the operator has scrolled up to the Marathon station and actuated the select switch 63. The detail display 87 shows the distance to the Marathon station (*i.e.*, 5.7 miles), and an arrow 88 shows the general direction of the station. The street address 89 of the service station, as well as its telephone number 89'. As the vehicle travels to the exit from which the POI was selected in the highway mode, this information is dynamically updated. Thus, arrow 88 changes direction and the distance information 87 of Fig. 15 is continuously updated. The distance displayed is the combined distance to the exit and from the exit to the Marathon station.

When the vehicle exits the highway, for example, at exit 102A, as shown in Fig. 7, the microprocessor detects from GPS signal and stored road network data programmed in the memory 31 that it is on a secondary road and automatically switches to one of the local point-of-interest displays shown in Figs. 8A or 8B, which, unless a POI has previously been selected as seen in Fig. 15, automatically displays the categories of points of interest available, the number of points of interest in each category through the icons 71, 73, and 75, and the nearest points of interest within a selectable range of, for example, two to four miles of the nearest points of interest regardless of the category. Again, the operator can select any one of the categories by actuating the switches 65, 66, and 67 after which the selected category will be displayed as shown in Figs. 12-14, and a go-to point of interest can be selected by movement of the cursor through actuation switches 61 and 62 and entry of a highlighted point of interest by select switch 63 to obtain the information for that point of interest, as represented, for example, by Fig. 15. If a POI had previously been selected, the display of Fig. 15 remains displayed to the operator.

If there are no points of interest found at a forthcoming exit, the display of Fig. 18 is displayed to the vehicle operator indicating that, at that exit, no selected category points of interest are available. The operator can either scroll forward to exits ahead of the vehicle or scroll backward using switches 61, 62 to a previous exit to look for a desired point of interest and determine which is the closest point of interest which satisfies the operator's needs. If on a local road and no POI are found within an initial

search range, the system will expand the search range until a POI is found and display either the Fig. 8A or Fig. 8B display to the operator.

5 In addition to the point-of-interest mode of operation, the operator can enter the street sign mode from the main menu by pushing the menu switch 60 and scrolling to street signs (Fig. 6). By actuating the select switch 63, the display of Fig. 9 is presented
10 to the operator, which shows the direction 91 of travel of the vehicle, the road 92 on which the vehicle is traveling, and a street address display 93, which shows the street numbers and which increments or decrements as the vehicle travels along the street, to provide the operator with the ability to locate a point of interest which may have
15 previously been identified by street number or is otherwise known to the operator. This display is particularly helpful where the point of interest is set back from the road, such as, for example, in a shopping mall or the like, and the address is not readily visible from the road. As is well known, the displayed address is interpolated from two known locations and the current vehicle position with respect to such locations as determined by the GPS information.

If the operator scrolls forward utilizing switch 61 while in the street sign mode displaying addresses, as shown in Fig. 9, the system enters the display of cross streets, as shown in Fig. 10, in which two streets ahead of the vehicle (*e.g.*, Second Avenue and Third Avenue in Fig. 10) are presented, as are arrows 94 indicating the location of the
20 vehicle between Second Avenue and recently passed First Avenue. This provides the operator with an easily recognizable display of cross streets on a roadway defined by converging graphic lines 95, which includes arrows 94 to provide a clear graphic diagram to the vehicle operator as to the vehicle's location with respect to forthcoming cross streets. In the event that the area does not provide cross-street information or
25 street addresses for a given location of the vehicle, a display is provided to the operator, indicating that such information is not available and the operator must return to the main menu and enter the highway or local point-of-interest mode for guidance. The operator can always select the current information display of Fig. 11 by actuating the back button 64 when in any of the other modes until the information is displayed or actuate the menu
30 button and actuate cursor switches 61, 62 to align cursor 27 with current information and actuate the select switch 63 to provide the compass, temperature, time, and date information display of Fig. 11.

Fig. 5 illustrates the various operational modes described above by the actuation of the select, menu, back, scroll, and POI switches to select points of interest, select a category contained within the points of interest, identify a particular establishment in that category, and go to the point-of-interest display, which provides detailed information as to how to approach the selected point of interest. The flow diagram 100 of Figs. 22A, 22B, and 22C represents the programming of the microprocessor through the program contained in memory 31 of Fig. 4 to detect the actuation states of the various operator-actuated switches look at the data from the GPS receiver 40 and the flash memory 29 and display the resultant selected display information. The figure numbers of the display figures are included in the flow diagram 100.

Turning initially to Fig. 22A, the main menu 110 of Fig. 6 is displayed and the program looks at block 112 to determine if a highlighted entry has been selected and, if it has, whether the point of interest has been selected at block 114. If a point of interest display has been selected, the program moves to block 102 (Fig. 22B) and displays the point-of-interest menu of Fig. 7 or Fig. 8, depending on the location of the vehicle, either on a limited access highway or on a local roadway. If no entry has been selected in block 112, the program cycles through the main menu until such time as something has been selected by scrolling to and highlighting a desired entry. If no point of interest has been selected, the program detects at block 116 whether the street sign has been selected and, if not, at block 118, whether the current information has been selected. If current information has been selected, the display of Fig. 11 is presented, as shown by block 120. If street signs has been selected, the display of current address of Fig. 9 is presented as shown by block 122. If street signs is not selected and current information is, the program automatically updates from the data received from the compass, temperature sensor, and internal clock the information displayed in Fig. 11. The program then continues to detect at blocks 124 and 126 (Fig. 22B) whether or not menu or back has been selected. If not, it remains with the current display of Fig. 11.

If, at block 118, current information has not been selected, the program tests at block 128, whether the off selection has been entered and, if not, the program returns to the main menu 110. If off has been selected at block 128, the display is turned off, as indicated by block 134 (Fig. 22A), and the system is idle until such time as any switch

has been depressed, as indicated by block 136. When this occurs, the program returns to the main menu block 110 of Fig. 22A.

5 If a point of interest display has been actuated as indicated by an affirmative decision in block 114, the program moves to block 102 (Fig. 22B), displaying either the Fig. 7 or Fig. 8 menu, as indicated above. If a point of interest is not selected as indicated by a no decision in block 104, the program continues to look to see if menu or back has been selected at 130, 132 and, if not, cycles through the loop, including blocks 102 and 104, until such time as either a lodging point-of-interest key 67 (Fig. 2) has been actuated as indicated by block 105, a gas point-of-interest key 65 (Fig. 2) has been actuated, or a food point-of-interest key 66 has been selected as indicated by blocks 105-107, respectively, in Fig. 22B. If one of these categories has been selected as indicated by block 108, the point of interest distance, direction, and location of Fig. 15 is displayed. The program then detects whether a menu or back select switches have been actuated at blocks 140 and 142 and, if so, the program returns to either the main menu or displays the point-of-interest menu, as indicated in block 102.

15 If "street signs" is selected as indicated in block 116 (Fig. 22A) and the address of Fig. 9 is displayed, the program tests to determine if a menu select or back select switch has been actuated as indicated by blocks 144 and 146 (Fig. 22B). If the menu select switch has been actuated, the program returns to the main menu of block 110. If not and the back select switch has been actuated by an affirmative decision in block 142, the program also returns to the main menu. If the back select switch has not been actuated, the program tests to determine if the down arrow at block 148 has been actuated. If it has, the program displays the street sign mode of Fig. 10, as shown at block 150 and continues to display that until such time as either the menu select switch at block 152 has been actuated or the back select switch at block 154 has been actuated or the up arrow as indicated by block 156 has been actuated. If the down arrow select switch has not been actuated at block 148, the program returns to the current address display as shown at block 122. If the arrow up select switch has been actuated as indicated by an affirmative decision at block 156 or the back select switch activated, the program returns to the current address display of Fig. 9 indicated at block 122.

30 Thus, the flow diagram of the program of Figs. 22A-22C illustrates the operation performed by the program during a sequence of operation through the menu as shown

also in Fig. 5, as well as at the same time updating the location information from the GPS receiver and selected point-of-interest information, including distance to and/or direction to the selected point-of-interest information being displayed.

5 It will become apparent to those skilled in the art that various modifications to the preferred embodiment of the invention as described herein can be made without departing from the spirit or scope of the invention as defined by the appended claims.

The invention claimed is:

1. A point-of-interest memory system for use in a vehicle comprising:
a database including roadway data including highway identification information
5 including exits and location information, street names and address numbers and the
location and identification of points of interest, wherein said database has data sets
layered thereon according to road network information and separately point-of-interest
information such that said database can be updated separately at different time intervals
for separately updating the road network information and point-of-interest information.
10
2. The system as defined in claim 1 wherein said database is programmed into a
programmable memory.
3. The system as defined in claim 2 wherein said programmable memory is a
15 removable memory device.
4. The system as defined in claim 3 wherein said removable memory device is a
flashcard.
- 20 5. The system as defined in claim 4 wherein said system includes:
a GPS receiver;
a display; and
a microprocessor coupled to said memory, to said GPS receiver, and to said
display for displaying point-of-interest information to an operator of a vehicle in which
25 said system is installed.
6. The system as defined in claim 5 and further including at least one operator-
actuated switch coupled to said microprocessor to allow the operator to select for
individual display one of addresses on a street on which the vehicle is traveling and
30 separately cross-streets ahead and behind the vehicle.

7. The system as defined in claim 6 wherein said display of addresses further includes a display of the street name on which the vehicle is traveling.
8. The system as defined in claim 7 wherein said display of cross streets includes
5 graphic lines depicting sides of a roadway and the cross streets are positioned between said lines.
9. The system as defined in claim 8 wherein said display of cross streets includes at least one arrow aligned with respect to the displayed cross streets at a position indicating
10 the position of the vehicle with respect to said cross streets.
10. The system as defined in claim 9 wherein said display displays two cross streets ahead of the vehicle.
11. The system as defined in claim 10 wherein said display includes two arrows with
15 an arrow positioned adjacent each graphic line representing a side of a roadway.
12. The system as defined in claim 6 and further including at least one operator actuated switch which permits the operator to select a point of interest from a menu of
20 available points of interest when on a highway and said display displays the distance and direction to said selected point of interest.
13. The system as defined in claim 6 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest and
25 said display selectively displays detailed information regarding a selected point of interest.
14. The system as defined in claim 12 wherein said operator-actuated switch permits the operator to selectively display the exits on a highway on which the vehicle is
30 traveling, wherein said microprocessor is programmed to respond to operator input signals from said switch to provide a scroll-forward display of upcoming highway exits and for displaying points of interest accessible at such highway exits

15. The system as defined in claim 5 and further including an electronic compass coupled to said display.

5 16. The system as defined in claim 5 and further including an outside temperature sensor coupled to said display.

17. The system as defined in claim 5 and further including a trip computer coupled to said display.

1/13

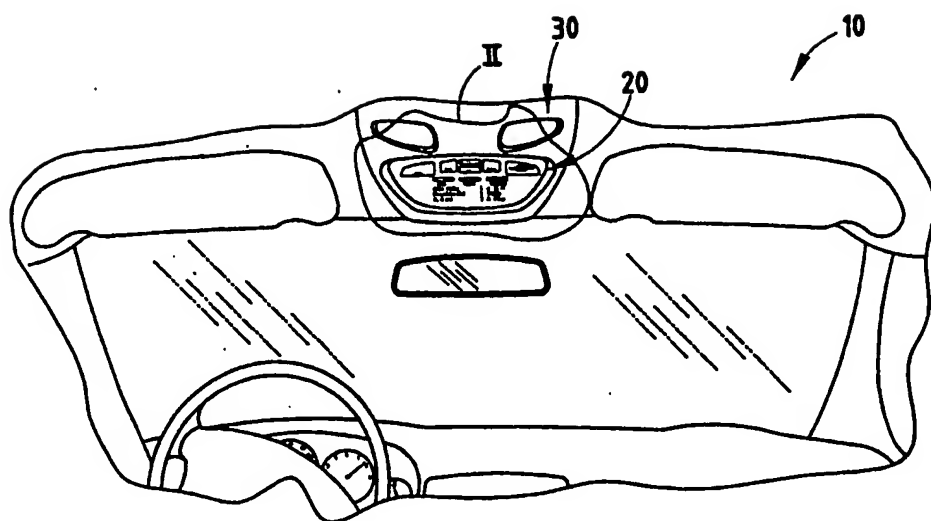


FIG. 1

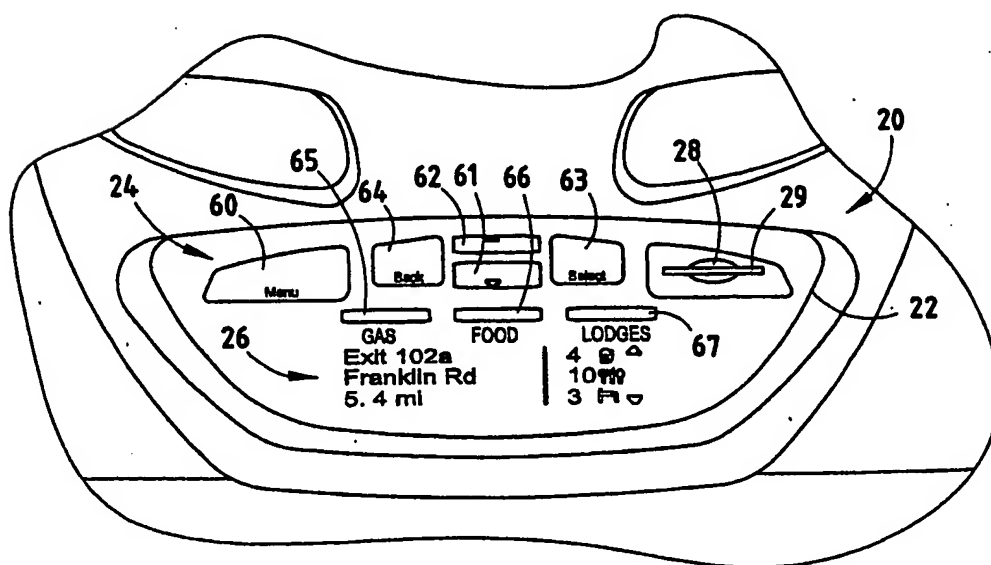


FIG. 2

2/13

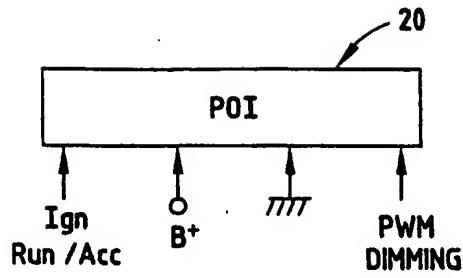


FIG. 3

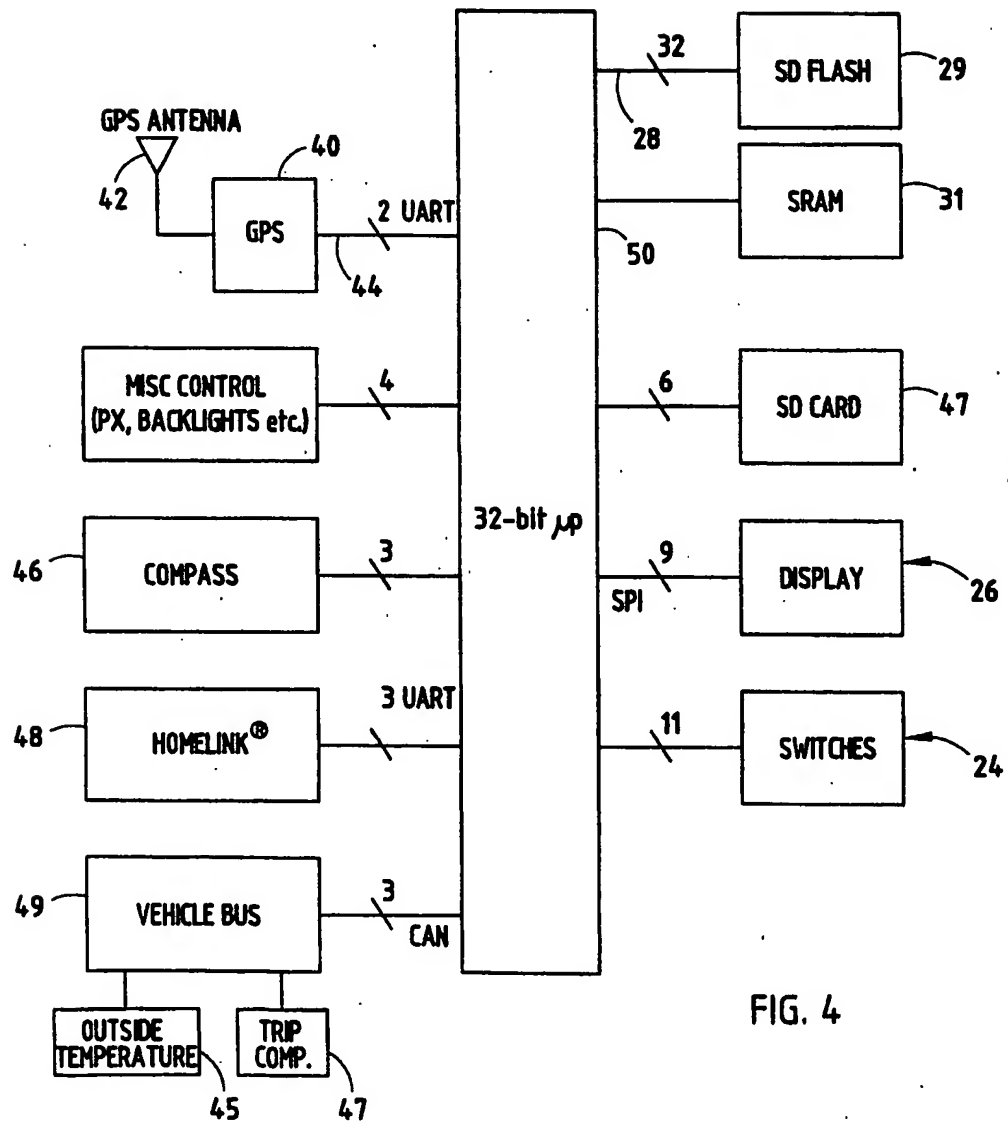


FIG. 4

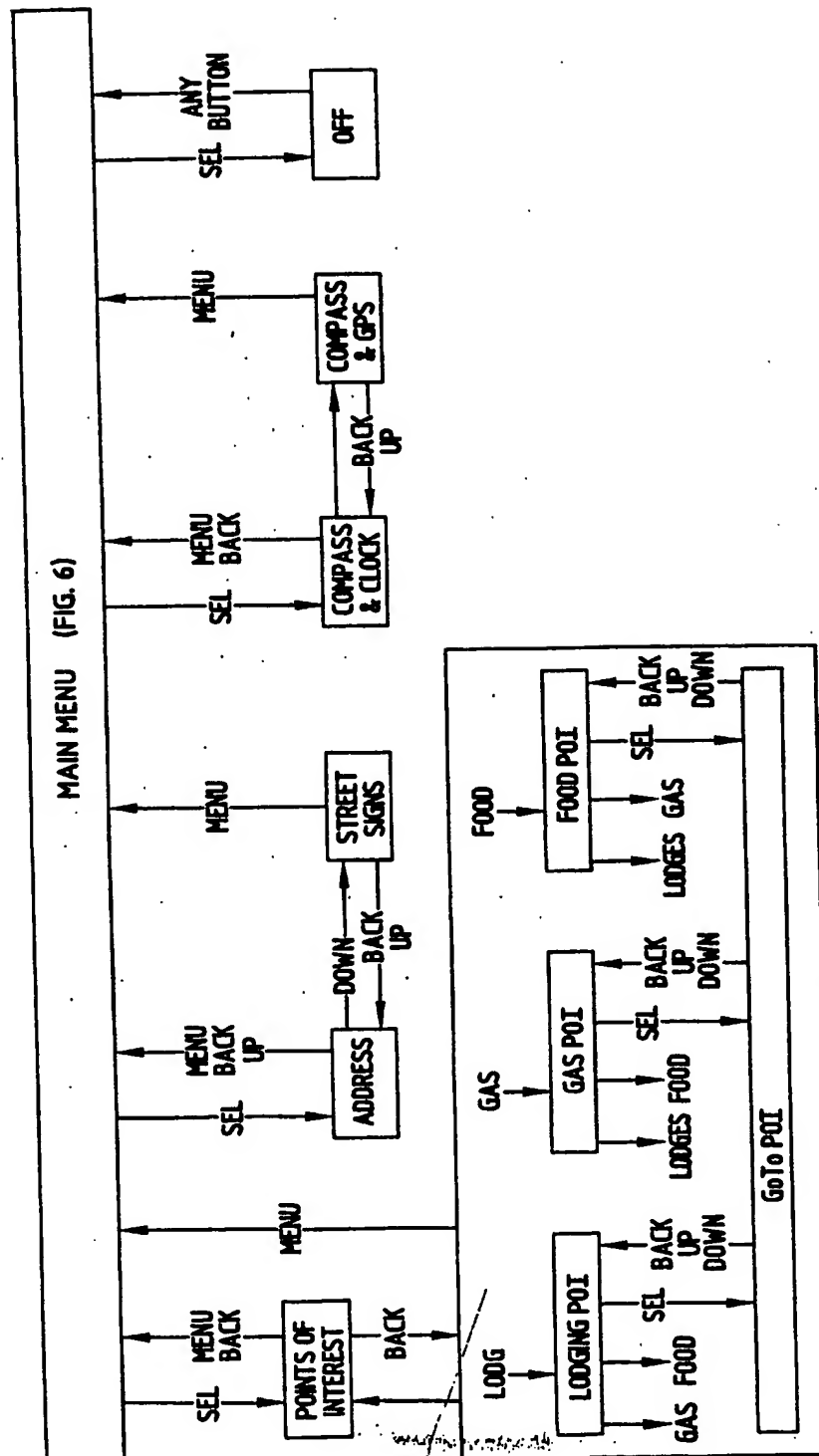


FIG. 5

4/13

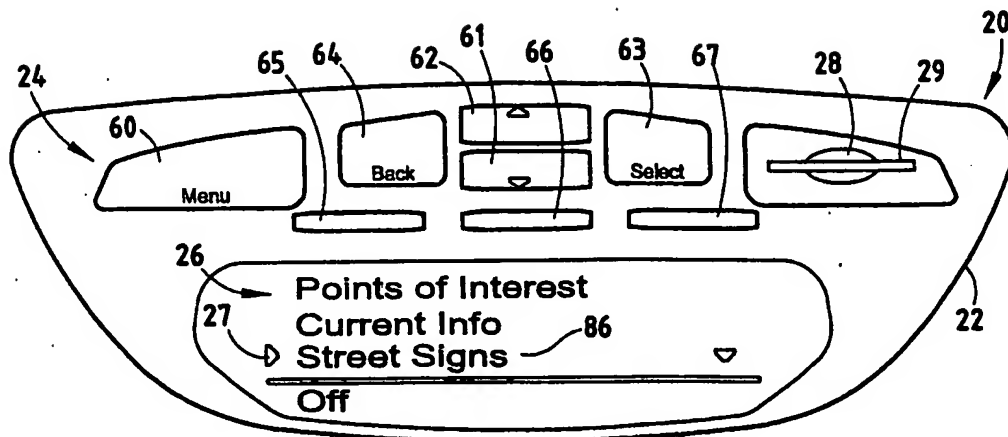


FIG. 6

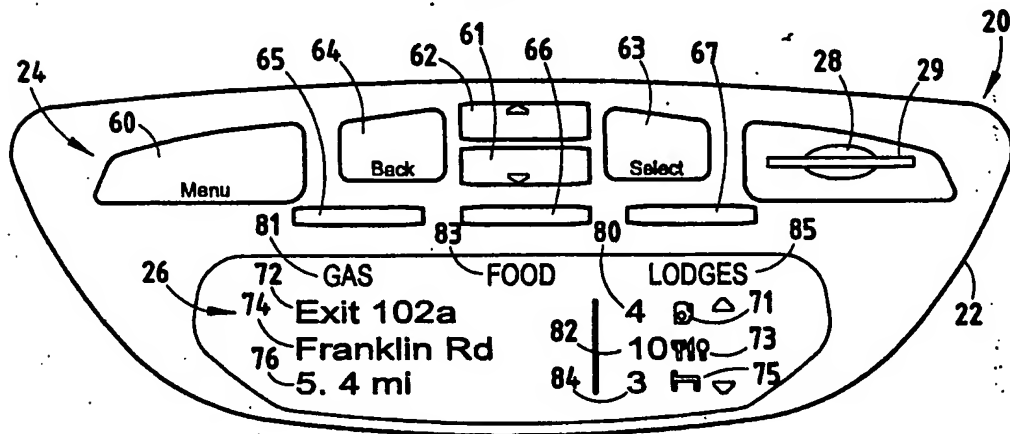


FIG. 7

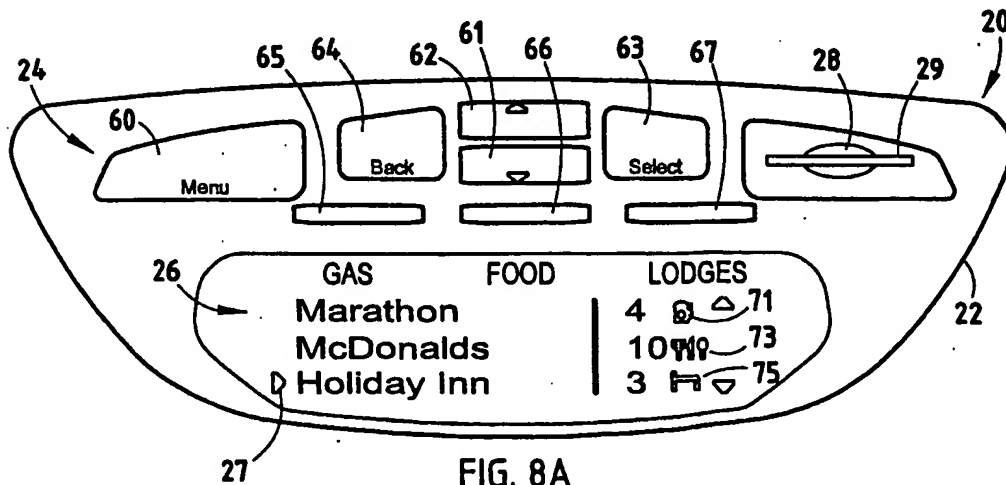


FIG. 8A

5/13

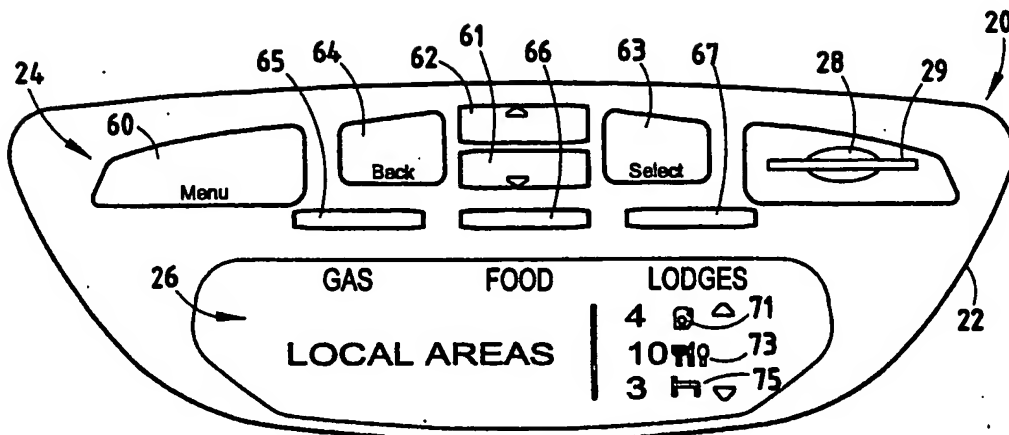


FIG. 8B

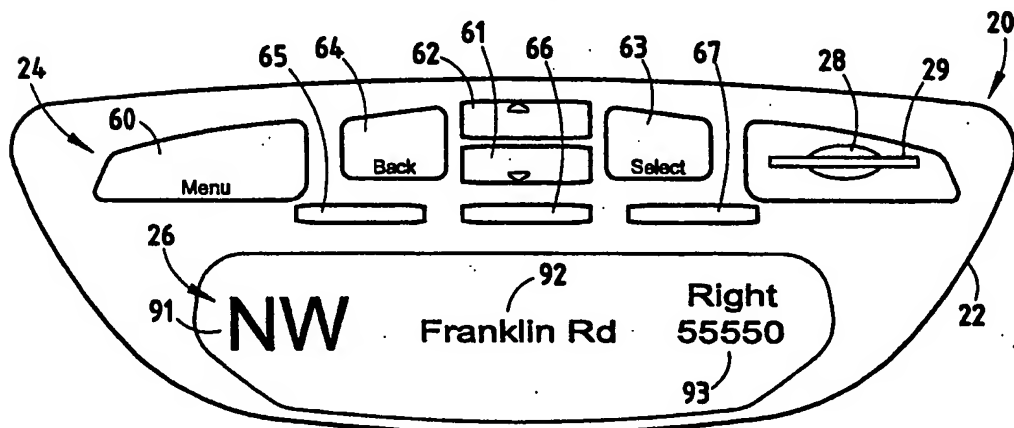


FIG. 9

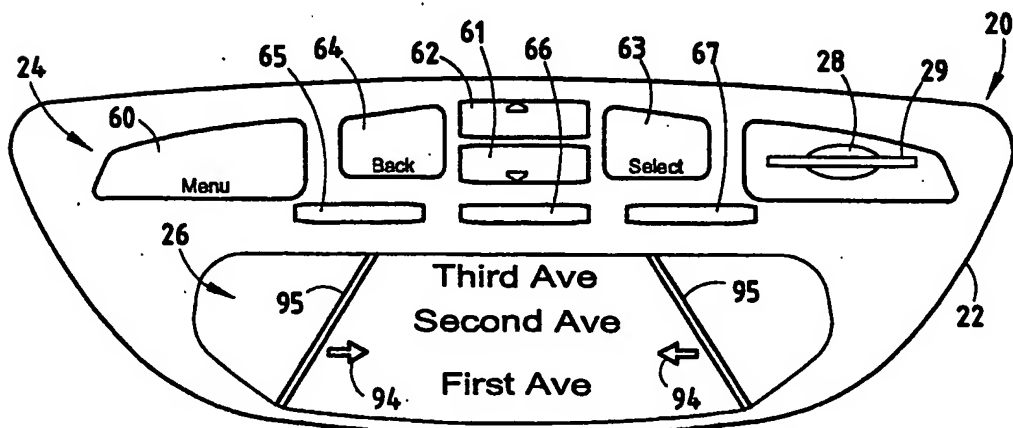


FIG. 10

6/13

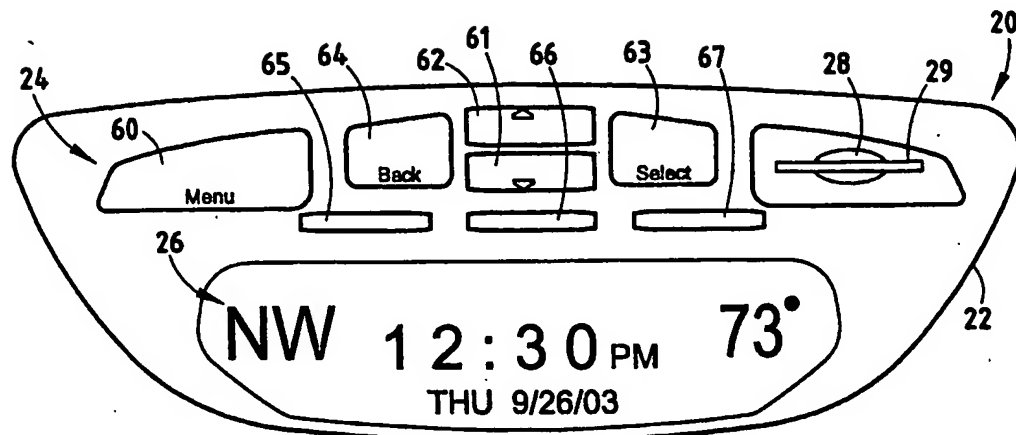


FIG. 11

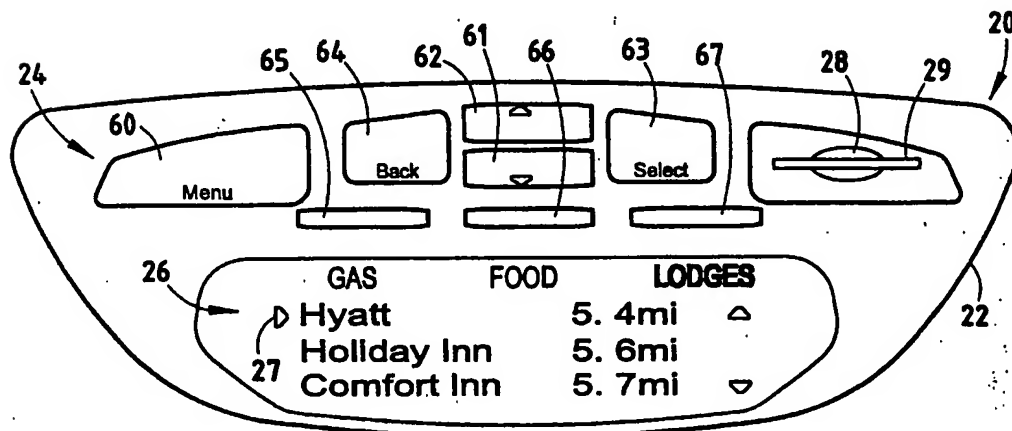


FIG. 12

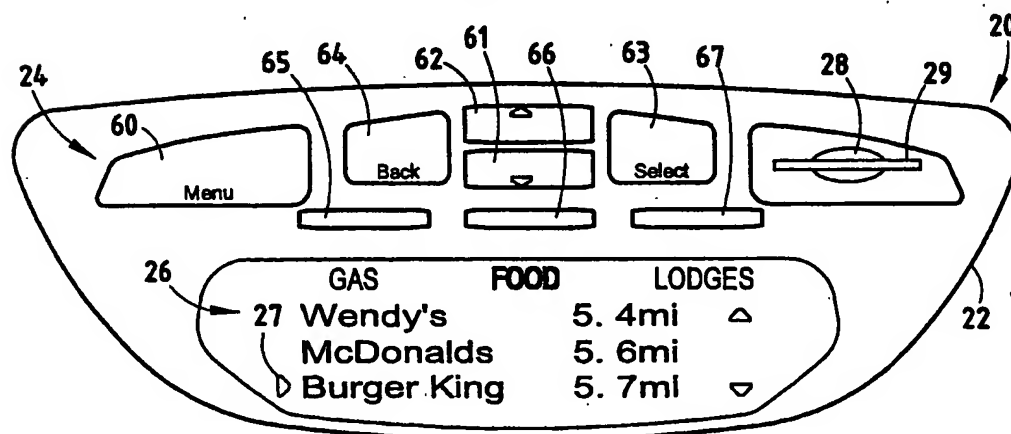


FIG. 13

7/13

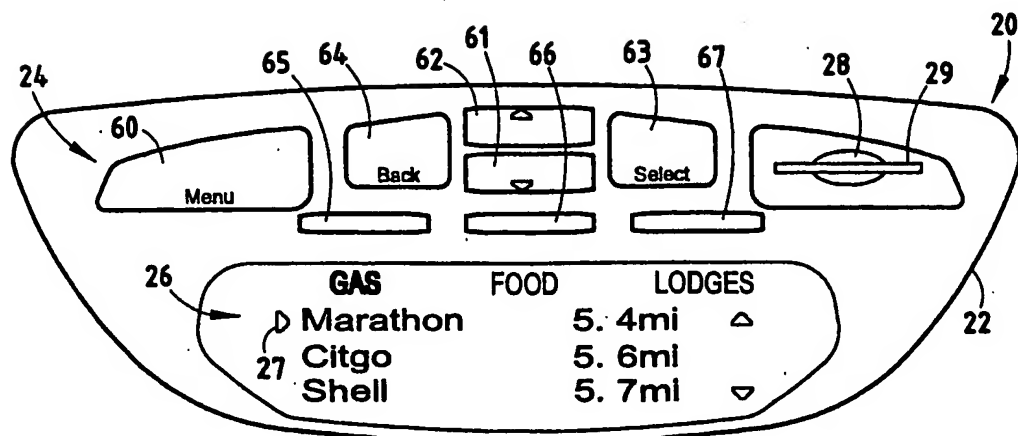


FIG. 14

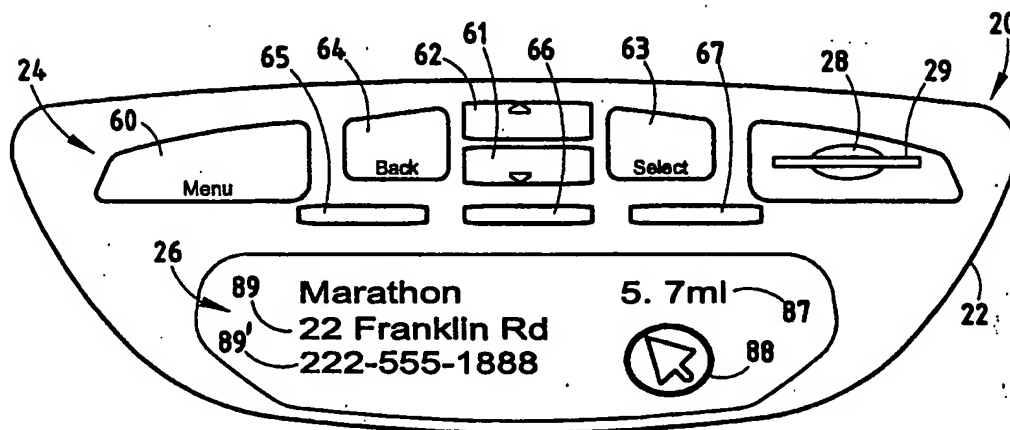


FIG. 15

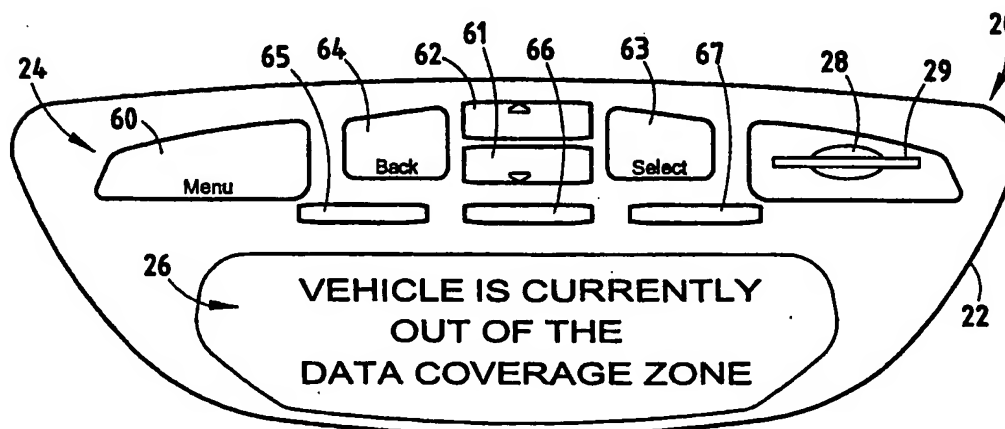


FIG. 16

8/13

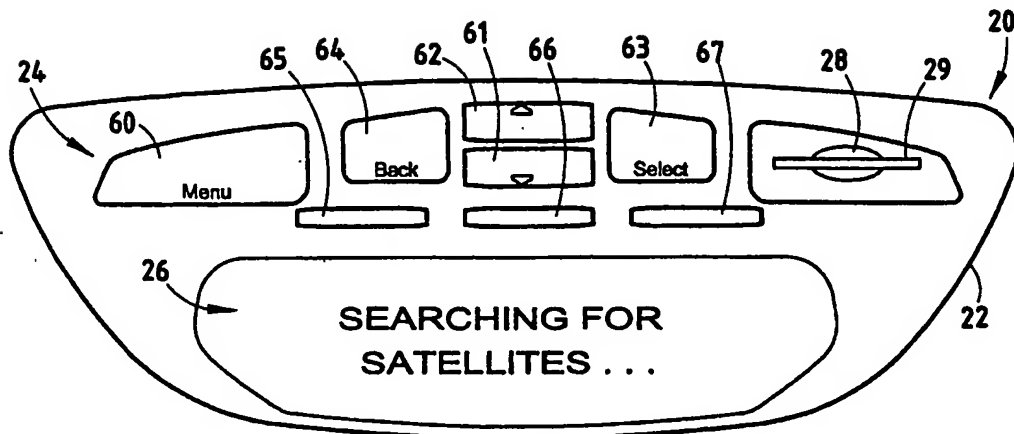


FIG. 17

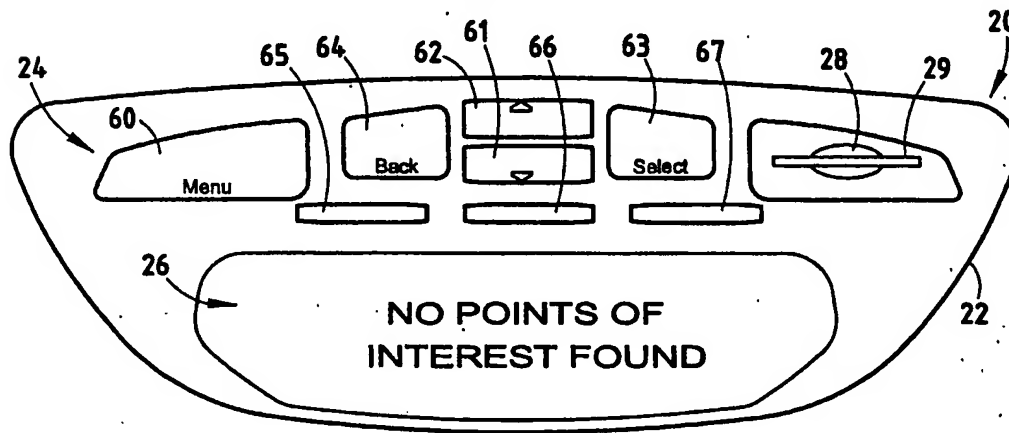


FIG. 18

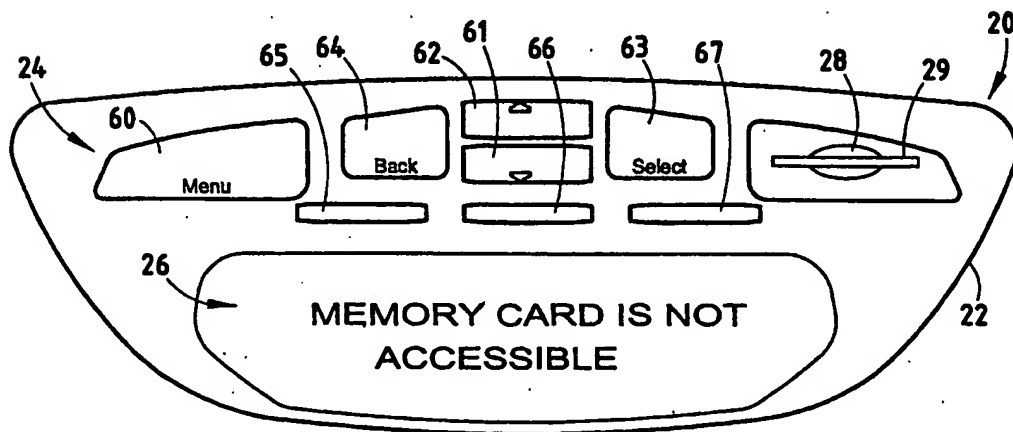


FIG. 19

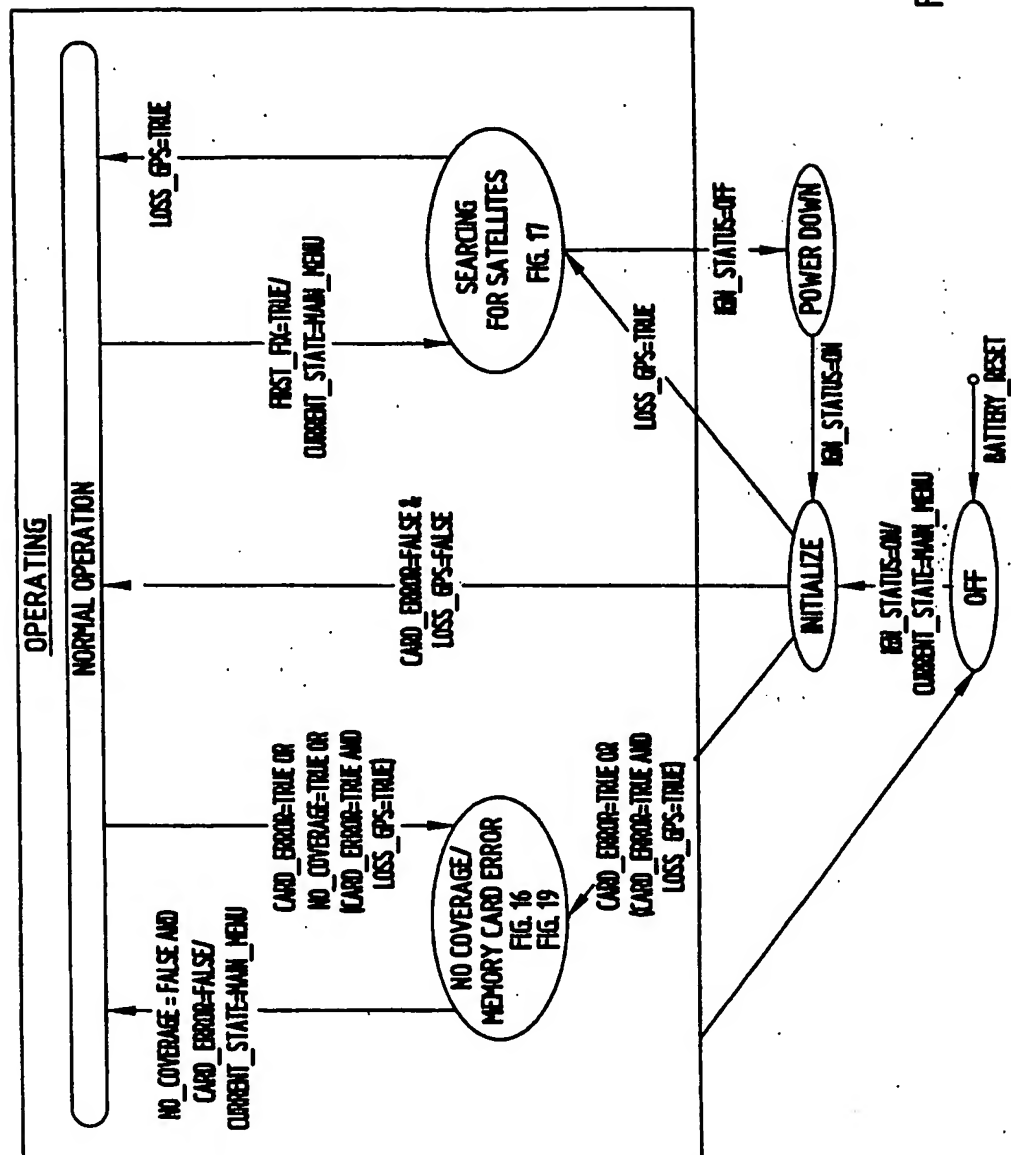


FIG: 20

10/13

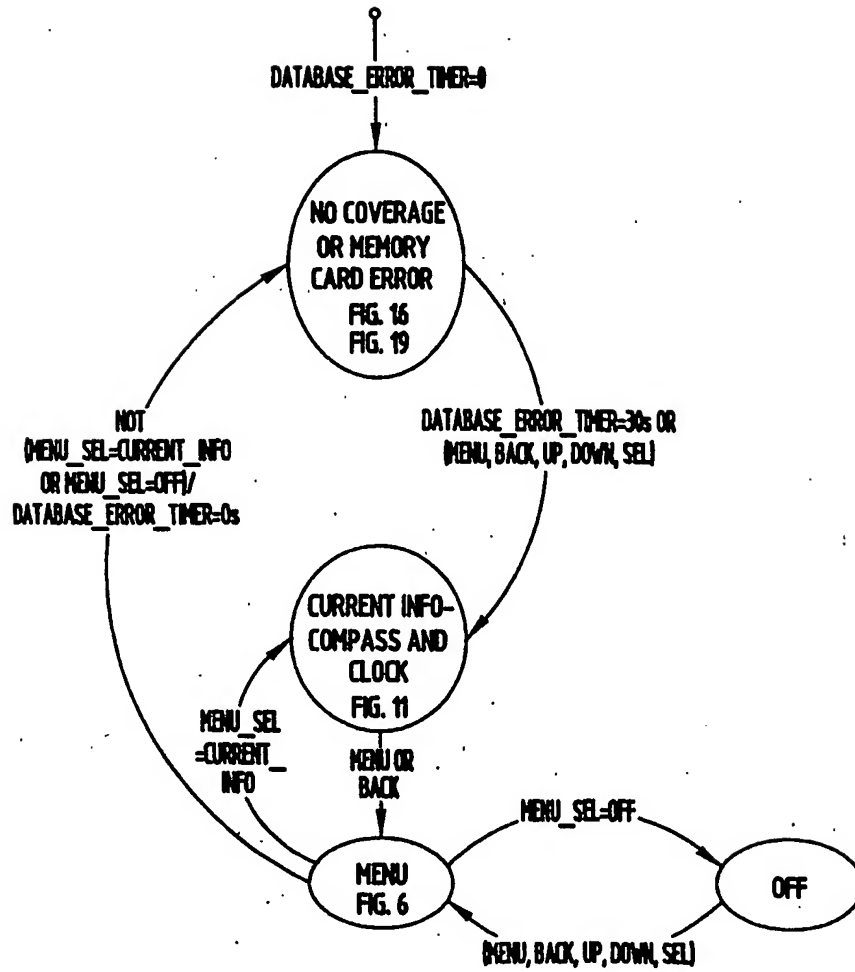


FIG. 21

11/13

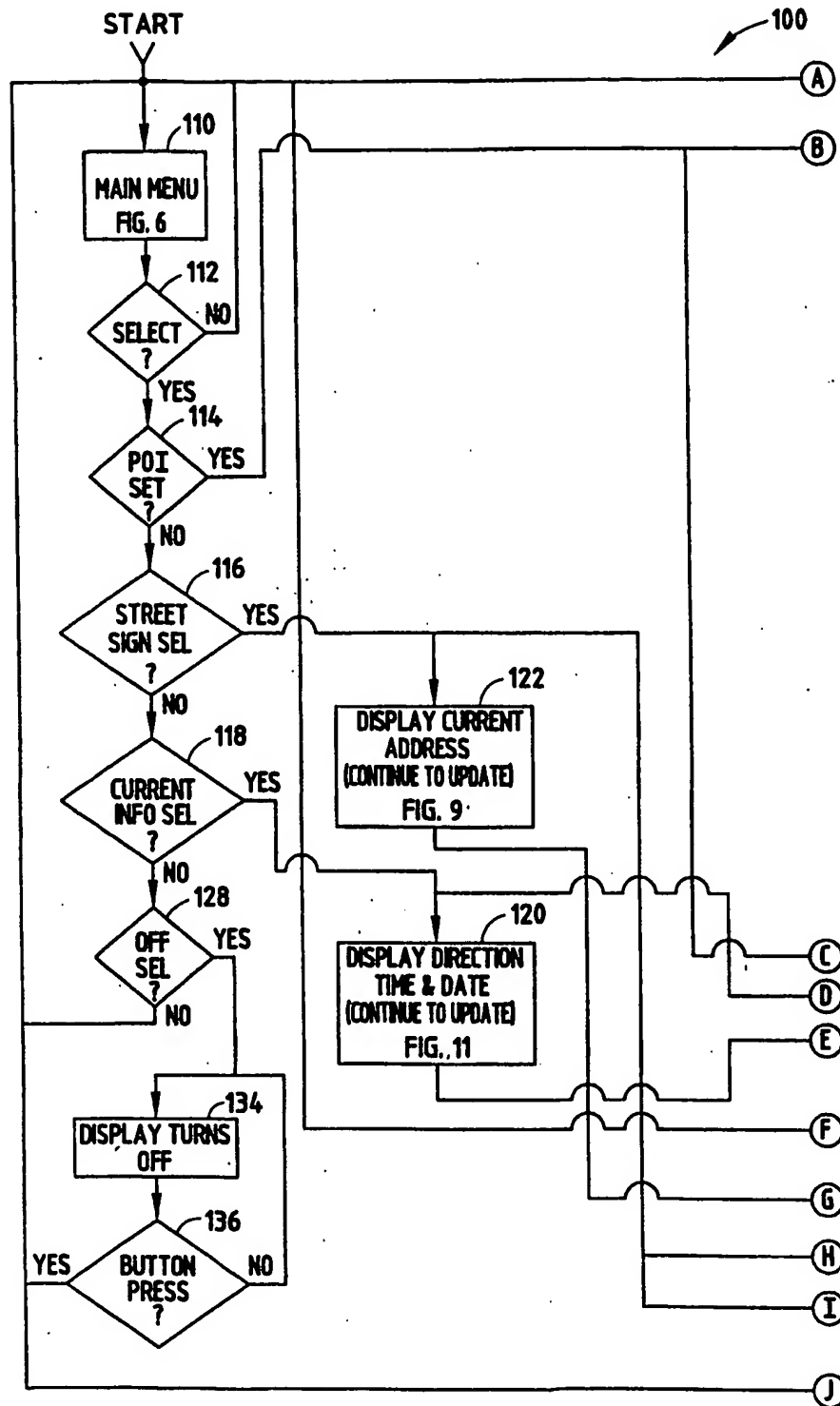


FIG. 22A

12/13

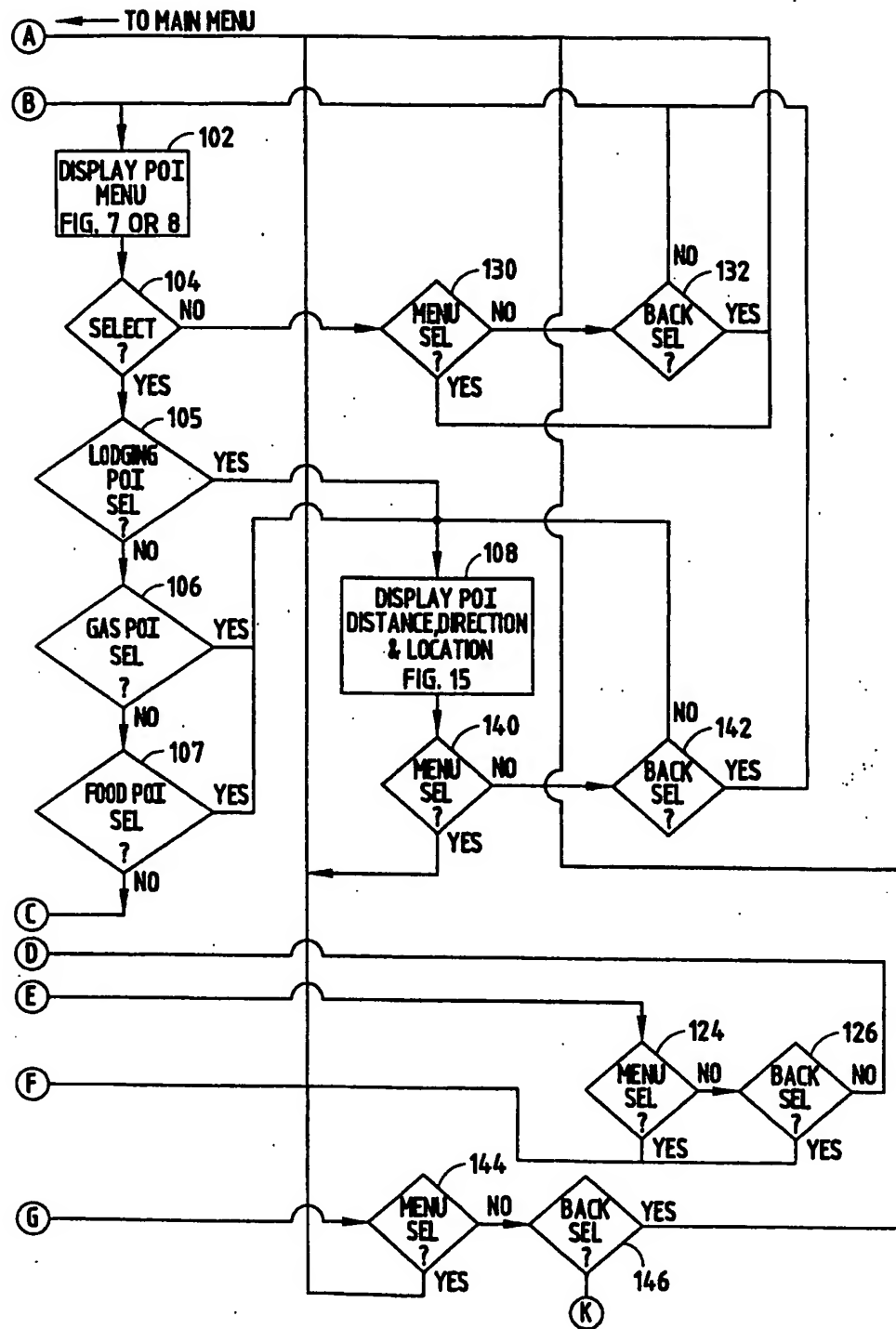


FIG. 22B

13/13

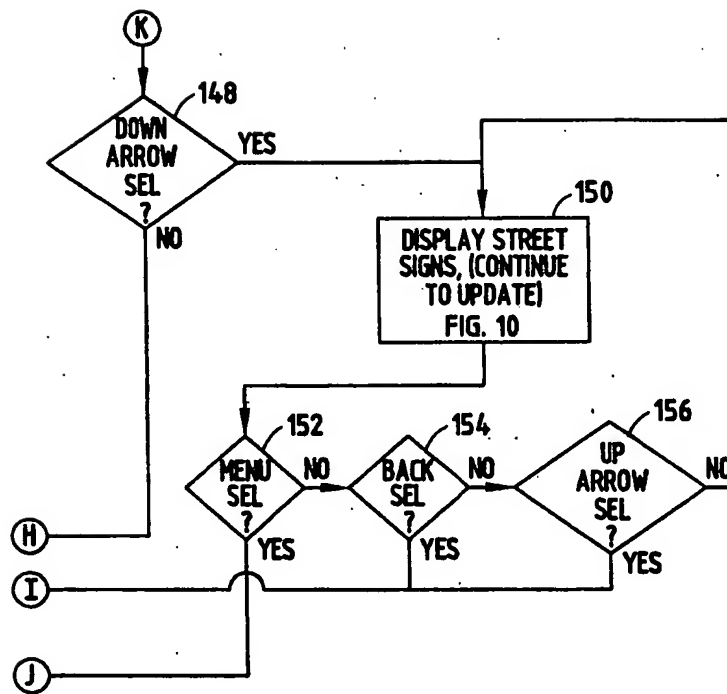


FIG. 22C

POINT-OF-INTEREST DISPLAY SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a display system for a vehicle and particularly to one which provides a display of selected names of points of interest arranged by category and elemental directions to a selected point of interest. One embodiment provides a graphic display of cross-streets or addresses as the vehicle travels along a local roadway.

There exist numerous vehicle navigation systems which provide graphic map displays, which allow the vehicle operator, through significant manipulation of controls, to plan a travel route and obtain information about arrival destinations, typically by address. Some systems provide navigation control through the use of voice recognition programs and control circuits. All of these systems are relatively expensive, complicated and difficult for a vehicle operator to utilize, particularly when preoccupied with surrounding traffic in congested areas. Some suggested simplified navigation systems allow the vehicle operator to either identify his or her current location by street address and forthcoming intersection information, as well as basic points of interest information. Such systems are relatively inexpensive but do not provide the operator with the flexibility of providing points-of-interest information in a user-friendly format nor additional desirable features, such as easily accessible alternate displays of forthcoming highway exits, street intersections, or street addresses when traveling on a local street.

Thus, there remains a need for a display system for a vehicle which is relatively inexpensive and is user-friendly to operate using a minimum number of intuitive controls. Such a system needs to provide desirable features, such as points of interest in selected categories which can be easily accessed with minimal operator intervention and yet provide the operator with sufficient information to be able to locate and travel to such points-of-interest.

SUMMARY OF THE INVENTION

The system of the present invention satisfies this need by providing a point-of-interest display system in which an updateable database includes road network information, which can be updated at relatively infrequent time intervals, and point-of-

interest information which can be user-updated at more frequent intervals, as new points of interest become available. In a preferred embodiment of the invention, the database is carried on the vehicle in the form of a flashcard or other removable memory device or loaded into flash memory residing in the vehicle via a data communication system. The database interfaces with a microprocessor on the vehicle which receives data from a current position detector, such as a GPS receiver, providing the system with current vehicle location and direction of travel information. A display provides the operator textural and elemental graphic display information, and one or more control switches are positioned in an easily accessible location within the vehicle such that the operator, by scrolling through displayed highway exits, can select categories of points of interest, and points of interest within a category upon the actuation of a minimal number of switches in an intuitive sequence.

In one embodiment of the invention, two modes of operation provide point-of-interest information either while the vehicle is traveling on a limited access highway or, once the vehicle has exited the highway, provides more specific point-of-interest directions. In another embodiment of the invention, the operator can, when on a local road, select the textural display of forthcoming and past intersecting streets, which is updated as the vehicle travels along the roadway. In yet another embodiment of the invention, the navigation system provides a display of the street addresses on which the vehicle is traveling and increments, decrements, or otherwise updates the address as the vehicle moves. In a preferred embodiment of the invention, each of these features are incorporated in a system which allows selection between the features, either manually or automatically as the vehicle moves between a limited access highway and a local roadway.

These and other features, objects and advantages of the present invention will become apparent upon reading the following description thereof together with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a fragmentary perspective view of a vehicle having a point-of-interest display system embodying the present invention;

Fig. 2 is an enlarged fragmentary view of the system shown in Fig. 1;

Fig. 3 is a block electrical diagram showing one interface connection of the system to the vehicle power system;

Fig. 4 is a block electrical circuit diagram of the point-of-interest system including its major components;

Fig. 5 is a flow diagram showing the menu operation for operation of the system shown in Figs. 1-4;

Fig. 6 is the display screen for the main menu;

Fig. 7 is the display screen illustrating the information displayed to the vehicle operator when in a highway point-of-interest mode of operation;

Figs. 8A and 8B are alternate display screens illustrating the information displayed to the vehicle operator when in a local point-of-interest mode of operation;

Fig. 9 is the display screen illustrating the information displayed to the vehicle operator when in a street-address mode of operation;

Fig. 10 is the display screen illustrating the information displayed to the vehicle operator when in a street-sign or cross-street mode of operation;

Fig. 11 is the display screen illustrating the information displayed to the vehicle operator when in a current-information mode of operation;

Fig. 12 is the display screen illustrating the information displayed to the vehicle operator when the lodging category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 13 is the display screen illustrating the information displayed to the vehicle operator when the food category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 14 is the display screen illustrating the information displayed to the vehicle operator when the gas category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 15 is the display screen illustrating the information displayed to the vehicle operator when a particular point of interest in the highway mode has been selected;

Fig. 16 is the display screen illustrating the information displayed to the vehicle operator when the vehicle is out of the coverage zone;

Fig. 17 is the display screen illustrating the information displayed to the vehicle operator during initial start up when the GPS receiver is looking for satellites;

Fig. 18 is the display screen illustrating the information displayed to the vehicle operator when no point of interest was found at a selected exit;

Fig. 19 is the display screen illustrating the information displayed to the vehicle operator in the event a memory card has not been inserted into the circuit;

Fig. 20 is a flow diagram of the operation of the system during start up and shut down;

Fig. 21 is a flow diagram of the normal operation mode of the system; and

Figs. 22A, 22B, and 22C are a detailed flow diagram of the programming of the system during operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring initially to Fig. 1, there is shown a vehicle 10, such as an automobile, van, sports utility vehicle, truck, or the like, which incorporates a point-of-interest display system of one embodiment of the present invention. The point-of-interest display system 20 is mounted in one embodiment in an overhead console 30, although it can be mounted at any conveniently accessible location within easy reach of the vehicle operator, such as in the instrument panel. The point-of-interest system includes a switch group 24 and a display section 26, shown in detail in Fig. 2. The point-of-interest system can be mounted within a housing 22, which includes both the display 26 and switch section 24, as well as a memory card slot 28 for receiving a removable memory card 29, such as a flashcard on which the point-of-interest and road network data is programmed. Alternatively, separate mounting of the components is possible.

The memory card 29 typically will be at least a 128 meg card, although 256 or 512 meg cards may be preferred. The memory card is removable from slot 28, such that data thereon, including road network information and point-of-interest (POI) information, can be separately programmed in layers thereon, such that the road network and POI data can be refreshed at different, periodic intervals. Memory card 29 includes nonvolatile memory and contains a handshake code to communicate with a microprocessor 50 (Fig. 4) of the system, so the microprocessor can read data on the memory card 29. The system, as seen in Fig. 4, also includes a programmable SRAM memory 31, which contains the program for the sequential operation of the system, as shown in Fig. 5. The flow diagram for the program is shown in Figs. 22A, 22B, and 22C, described below. In one embodiment memory card 29 can be obtained from a car

dealer with an update subscription service for refreshing the data on the card either annually, in the case of road network information, or more frequently as new points of interest may become available, such as, for example, on a monthly basis. Alternatively, the user may subscribe to a web site providing download information for refreshing the data on memory card 29 on a personal computer if desired. Card 29 may also be updated through other means. Typically, the memory card will have data sufficient for a regional area in which the vehicle normally travels and will contain points of interest according to categories, such as gas, food, and lodging, as well as all the major (*i.e.*, limited access) and secondary road identifications and street addresses for secondary roads.

The map database is composed of at least two layers, at least one of which includes data like points of interest that change frequently. It is, therefore, desirable to update this information frequently. Another layer or layers of data contain information like the road network that may be undated less frequently. The data layers are linked and each layer may be updated either independently or in combination with other layers. This allows the consumer to obtain updated information without excessive download time when refreshing the data through the Internet, since the update can be limited to the part of the data that changes frequently.

Each layer is contained within a single file on the flashcard 29 for a given geographical area. Every POI record, whether for highway or local coverage, references a street name record in the road network file. This reference is stored in the POI file as an index into the street name table in the road network file.

As the latest POI information is released and compiled, every POI file that is created is associated with the latest road network file available. In addition, any new points of interest that are associated with roads that are not yet compiled into the latest road network file are added to the POI file but are flagged as being without a street name. All other POI attributes, such as telephone number, latitude/longitude and name, are still available in this case. Details of some aspects of the programming of the system to provide the various modes of operation are disclosed in Application No. 60/419,934, entitled **SYSTEM AND METHOD FOR DISPLAYING VEHICLE LOCATION AND POINT OF INTEREST INFORMATION**, the disclosure of which is incorporated herein by reference and in connection with the flow diagrams of Figs. 22A-22C.

The system, as best seen in Fig. 4, includes a current location detection device, such as GPS receiver 40, having an antenna 42 for receiving global positioning satellite signals from multiple satellites and providing current location data to one or more microprocessor(s) 50, which can be a Motorola MC9512DJ64 or its equivalent, through a universal asynchronous receiver/transmitter connection 44. Other current location detection sources of data, such as a Loran receiver, gyro compass, or dead reckoning information sources, may also be employed but a GPS receiver represents the current best mode of receiving such data. The microprocessor receives vehicle location data from the GPS receiver and point-of-interest and road network data from the flashcard 29, which is inserted into slot 28 and coupled to the one or more microprocessor(s) 50. An SRAM memory 31 is also coupled to the microprocessor(s) 50 and contains the system program. The microprocessor is also coupled to one or more operator-actuated switches in the switch section 24 and to a display 26, such as a dot matrix display, for selectively displaying information, such as shown in Figs. 2 and 6-19, to the vehicle operator.

The point-of-interest circuit 20 is coupled to the vehicle power system, as shown in Fig. 3, and includes an ignition input for receiving power when the ignition is either in the run or accessory position, a B+ input drawing a maximum of 300 micro amps when the system is deactivated, a coupling to the system ground and a pulse width modulated dimming input circuit for dimming the back-lighted switches of the switch bank 24 and the dot matrix display 26 based upon the operator's selected lighting level for instrument displays. In some installations, the system could be coupled directly to the vehicle's power supply through the ignition switch and vehicle ground. In another, dimming information is received from the vehicle bus. The microprocessor 50 is also coupled to other vehicle systems, such as a vehicle compass 46 for displaying in the normal mode of operation, when the point-of-interest system is not being employed, the outside temperature, the compass heading, the time and date information, as seen in Fig. 11. The microprocessor may also be coupled to and employed for other vehicle control functions, such as a Homelink® brand programmable transmitter 48, and may be coupled to the vehicle bus 49 for receiving PWM dimming information, ignition run, accessory information, and the like. An outside temperature sensor and circuit 45 may be coupled to the microprocessor(s) 50 or the vehicle bus 49, as shown in Fig. 4, to provide the

temperature display as seen in Fig. 11. Also, a trip computer 47 may be coupled to the microprocessor(s) 50 or to the vehicle bus 49, as shown in Fig. 4, to provide typical trip functions, such as a resettable odometer, fuel consumption, average speed, and estimated time of arrival information, which can be displayed on display 26.

The user-friendly, intuitive switch controls 24 are seen in Fig. 2 and incorporate a menu switch 60, a scroll forward switch 61, a scroll back switch 62, which are physically positioned on the console pointing in a forward and rearward position, respectively, with arrows thereon so as to intuitively indicate to the vehicle operator that the actuation of the scroll switches advances the display to a point of interest or highway exit forward or behind the vehicle. The switch controls 24 also includes a select switch 63 for selecting a given entry highlighted by the movement of a display cursor 27 (Fig. 8) through actuation of scroll switches 61 and 62 and a back switch 64, which allows the operator to move back one entry. Additionally, keys 65, 66, and 67 are provided and are aligned with display icons showing "gas", "food", and "lodges", respectively, as seen in Fig. 2. When the system is employed with a HomeLink® brand trainable transmitter, the switches can, when the POI system is off (Fig. 6), provide the dual function of operating any one of the three programmed transmitting frequencies and codes for up to three different garage doors, home appliances, security gates, or the like.

The operation of the system seen in Figs. 1-4 is best understood by reference to the program flow diagram of Figs. 22A, 22B, and 22C together with the menu diagram with Fig. 5 in connection with the displayed information, as seen in Figs. 2 and 6-19. Initially, when this system is powered up, as shown in Fig. 20, the system searches for satellites and displays a message, as shown by Fig. 17. In the event a memory card or flashcard 29 has not been inserted, the system displays the message shown in Fig. 19, either that the "memory card is not inserted" or the message shown in Fig. 16, that "the vehicle is out of the current data coverage zone." Assuming the memory card is in place and the vehicle is in the data coverage zone and satellite signals have been received, the display screen of Fig. 6 is displayed allowing the operator the option of selecting points of interest (POI) by scrolling, utilizing switches 61 and 62, current information which provides any combination of the compass heading, time, date, and/or outside temperature information of Fig. 11 or trip computer information (not shown). The operator may also select the street sign selection showing either the address of a street on

which the vehicle is traveling, if on a secondary road, as shown by Fig. 9, or, if the scroll button is advanced and street signs has previously been selected, to the street sign display of Fig. 10.

Assuming the vehicle is on a limited access highway and the operator has selected "points of interest" by scrolling to move the cursor 27, shown in Fig. 6, to the "points of interest" selection, the operator enters select by actuating switch 63, and the highway point-of-interest mode, as shown in Figs. 2 and 7, is displayed on display 26. Such display provides information as to points of interest according to categories of gas, food, or lodging, which are displayed as shown by display icons 71, 73, and 75 in Figs. 2 and 7. Display 26 also displays the forthcoming exit which the vehicle is approaching, as indicated by display area 72 (Fig. 7), the name of the street associated with the exit, as indicated by display element 74, and the distance to the exit, as shown by display element 76. To the left of display icons 71, 73, and 75 is a numerical display 80 for indicating the number of gasoline stations available at that exit (*i.e.*, 4 for exit 102a), a numerical display 82 indicating the number of restaurants available at that exit (*i.e.*, 10), and a numerical display 84 indicating the number of lodges or sleeping accommodations available at that exit (*i.e.*, 3). By actuating scroll switches 61 or 62, the operator can scroll forward to display, for example, the information available at the next exit (No. 103, for example) or the previous exit (No. 101, for example) if at exit 102 a desired POI is not available. Thus, while in the highway POI mode, the vehicle operator can look ahead or behind for points of interest and, as discussed below, select and review available points of interest at a selected exit. This enables the operator to find, for example, a favorite restaurant while traveling when meal time is approaching.

As the vehicle travels along the highway, the operator can actuate any one of the three keys 65, 66, or 67 aligned above the display 81 of "gas", display 83 of "food", or display 85 of "lodges", respectively, to select details of the establishments in the available categories at a selected exit. Thus, if the gas key 65 is actuated, the display of Fig. 14 appears, and the "gas" icon 81 is illuminated. The display of Fig. 14 provides three service stations available at the selected exit and their distance. A similar display presentation for restaurants is shown in Fig. 13 and for lodging is shown in Fig. 12.

The operator then can scroll to the desired establishment, such as a Marathon station, as shown in Fig. 14, by actuation of switches 61 and 62 and select the

establishment aligned with the cursor 27 to be presented with a more detailed route to point-of-interest display, as shown in Fig. 15. In Fig. 15, the operator has scrolled up to the Marathon station and actuated the select switch 63. The detail display 87 shows the distance to the Marathon station (*i.e.*, 5.7 miles), and an arrow 88 shows the general direction of the station. The street address 89 of the service station, as well as its telephone number 89'. As the vehicle travels to the exit from which the POI was selected in the highway mode, this information is dynamically updated. Thus, arrow 88 changes direction and the distance information 87 of Fig. 15 is continuously updated. The distance displayed is the combined distance to the exit and from the exit to the Marathon station.

When the vehicle exits the highway, for example, at exit 102A, as shown in Fig. 7, the microprocessor detects from GPS signal and stored road network data programmed in the memory 31 that it is on a secondary road and automatically switches to one of the local point-of-interest displays shown in Figs. 8A or 8B, which, unless a POI has previously been selected as seen in Fig. 15, automatically displays the categories of points of interest available, the number of points of interest in each category through the icons 71, 73, and 75, and the nearest points of interest within a selectable range of, for example, two to four miles of the nearest points of interest regardless of the category. Again, the operator can select any one of the categories by actuating the switches 65, 66, and 67 after which the selected category will be displayed as shown in Figs. 12-14, and a go-to point of interest can be selected by movement of the cursor through actuation switches 61 and 62 and entry of a highlighted point of interest by select switch 63 to obtain the information for that point of interest, as represented, for example, by Fig. 15. If a POI had previously been selected, the display of Fig. 15 remains displayed to the operator.

If there are no points of interest found at a forthcoming exit, the display of Fig. 18 is displayed to the vehicle operator indicating that, at that exit, no selected category points of interest are available. The operator can either scroll forward to exits ahead of the vehicle or scroll backward using switches 61, 62 to a previous exit to look for a desired point of interest and determine which is the closest point of interest which satisfies the operator's needs. If on a local road and no POI are found within an initial

search range, the system will expand the search range until a POI is found and display either the Fig. 8A or Fig. 8B display to the operator.

In addition to the point-of-interest mode of operation, the operator can enter the street sign mode from the main menu by pushing the menu switch 60 and scrolling to street signs (Fig. 6). By actuating the select switch 63, the display of Fig. 9 is presented to the operator, which shows the direction 91 of travel of the vehicle, the road 92 on which the vehicle is traveling, and a street address display 93, which shows the street numbers and which increments or decrements as the vehicle travels along the street, to provide the operator with the ability to locate a point of interest which may have previously been identified by street number or is otherwise known to the operator. This display is particularly helpful where the point of interest is set back from the road, such as, for example, in a shopping mall or the like, and the address is not readily visible from the road. As is well known, the displayed address is interpolated from two known locations and the current vehicle position with respect to such locations as determined by the GPS information.

If the operator scrolls forward utilizing switch 61 while in the street sign mode displaying addresses, as shown in Fig. 9, the system enters the display of cross streets, as shown in Fig. 10, in which two streets ahead of the vehicle (*e.g.*, Second Avenue and Third Avenue in Fig. 10) are presented, as are arrows 94 indicating the location of the vehicle between Second Avenue and recently passed First Avenue. This provides the operator with an easily recognizable display of cross streets on a roadway defined by converging graphic lines 95, which includes arrows 94 to provide a clear graphic diagram to the vehicle operator as to the vehicle's location with respect to forthcoming cross streets. In the event that the area does not provide cross-street information or street addresses for a given location of the vehicle, a display is provided to the operator, indicating that such information is not available and the operator must return to the main menu and enter the highway or local point-of-interest mode for guidance. The operator can always select the current information display of Fig. 11 by actuating the back button 64 when in any of the other modes until the information is displayed or actuate the menu button and actuate cursor switches 61, 62 to align cursor 27 with current information and actuate the select switch 63 to provide the compass, temperature, time, and date information display of Fig. 11.

Fig. 5 illustrates the various operational modes described above by the actuation of the select, menu, back, scroll, and POI switches to select points of interest, select a category contained within the points of interest, identify a particular establishment in that category, and go to the point-of-interest display, which provides detailed information as to how to approach the selected point of interest. The flow diagram 100 of Figs. 22A, 22B, and 22C represents the programming of the microprocessor through the program contained in memory 31 of Fig. 4 to detect the actuation states of the various operator-actuated switches look at the data from the GPS receiver 40 and the flash memory 29 and display the resultant selected display information. The figure numbers of the display figures are included in the flow diagram 100.

Turning initially to Fig. 22A, the main menu 110 of Fig. 6 is displayed and the program looks at block 112 to determine if a highlighted entry has been selected and, if it has, whether the point of interest has been selected at block 114. If a point of interest display has been selected, the program moves to block 102 (Fig. 22B) and displays the point-of-interest menu of Fig. 7 or Fig. 8, depending on the location of the vehicle, either on a limited access highway or on a local roadway. If no entry has been selected in block 112, the program cycles through the main menu until such time as something has been selected by scrolling to and highlighting a desired entry. If no point of interest has been selected, the program detects at block 116 whether the street sign has been selected and, if not, at block 118, whether the current information has been selected. If current information has been selected, the display of Fig. 11 is presented, as shown by block 120. If street signs has been selected, the display of current address of Fig. 9 is presented as shown by block 122. If street signs is not selected and current information is, the program automatically updates from the data received from the compass, temperature sensor, and internal clock the information displayed in Fig. 11. The program then continues to detect at blocks 124 and 126 (Fig. 22B) whether or not menu or back has been selected. If not, it remains with the current display of Fig. 11.

If, at block 118, current information has not been selected, the program tests at block 128, whether the off selection has been entered and, if not, the program returns to the main menu 110. If off has been selected at block 128, the display is turned off, as indicated by block 134 (Fig. 22A), and the system is idle until such time as any switch

has been depressed, as indicated by block 136. When this occurs, the program returns to the main menu block 110 of Fig. 22A.

If a point of interest display has been actuated as indicated by an affirmative decision in block 114, the program moves to block 102 (Fig. 22B), displaying either the Fig. 7 or Fig. 8 menu, as indicated above. If a point of interest is not selected as indicated by a no decision in block 104, the program continues to look to see if menu or back has been selected at 130, 132 and, if not, cycles through the loop, including blocks 102 and 104, until such time as either a lodging point-of-interest key 67 (Fig. 2) has been actuated as indicated by block 105, a gas point-of-interest key 65 (Fig. 2) has been actuated, or a food point-of-interest key 66 has been selected as indicated by blocks 105-107, respectively, in Fig. 22B. If one of these categories has been selected as indicated by block 108, the point of interest distance, direction, and location of Fig. 15 is displayed. The program then detects whether a menu or back select switches have been actuated at blocks 140 and 142 and, if so, the program returns to either the main menu or displays the point-of-interest menu, as indicated in block 102.

If "street signs" is selected as indicated in block 116 (Fig. 22A) and the address of Fig. 9 is displayed, the program tests to determine if a menu select or back select switch has been actuated as indicated by blocks 144 and 146 (Fig. 22B). If the menu select switch has been actuated, the program returns to the main menu of block 110. If not and the back select switch has been actuated by an affirmative decision in block 142, the program also returns to the main menu. If the back select switch has not been actuated, the program tests to determine if the down arrow at block 148 has been actuated. If it has, the program displays the street sign mode of Fig. 10, as shown at block 150 and continues to display that until such time as either the menu select switch at block 152 has been actuated or the back select switch at block 154 has been actuated or the up arrow as indicated by block 156 has been actuated. If the down arrow select switch has not been actuated at block 148, the program returns to the current address display as shown at block 122. If the arrow up select switch has been actuated as indicated by an affirmative decision at block 156 or the back select switch activated, the program returns to the current address display of Fig. 9 indicated at block 122.

Thus, the flow diagram of the program of Figs. 22A-22C illustrates the operation performed by the program during a sequence of operation through the menu as shown

also in Fig. 5, as well as at the same time updating the location information from the GPS receiver and selected point-of-interest information, including distance to and/or direction to the selected point-of-interest information being displayed.

5 It will become apparent to those skilled in the art that various modifications to the preferred embodiment of the invention as described herein can be made without departing from the spirit or scope of the invention as defined by the appended claims.

The invention claimed is:

1. A point-of-interest display system for a vehicle comprising:
 - a current location detector for providing data representing the vehicle's current position;
 - a database of information including points of interest and road network information including highway exits and local roadway street names and addresses;
 - a microprocessor coupled to said detector and to said database for providing display output signals representing upcoming highway exit information as the vehicle proceeds along a highway to provide point-of-interest information related to an exit and to provide display output signals for displaying points of interest within a predetermined range from the current vehicle location;
 - a display coupled to said microprocessor for displaying a predetermined number of points of interests within said predetermined range of the vehicle; and
 - at least one operator-actuated switch coupled to said microprocessor to permit the operator to select a point of interest from a menu of available points of interest when on a highway or after exiting a highway to obtain detailed information regarding a selected point of interest.
2. The system as defined in claim 1 wherein said detector is a GPS receiver.
3. The system as defined in claim 1 wherein said predetermined range comprises a range of less than about four miles.
4. The system as defined in claim 3 wherein the number of points of interest displayed is at least two.
5. The system as defined in claim 1 wherein said point-of-interest information includes the categories of gas, food, and lodging and individual establishments within each category when available.

6. The system as defined in claim 5 wherein each establishment is identified by name.
7. The system as defined in claim 6 wherein each establishment is further identified by its address.
8. The system as defined in claim 7 wherein a phone number of a selected establishment is displayed.
9. The system as defined in claim 1 wherein said database has data sets layered thereon according to road network information and point-of-interest information such that said memory can be updated separately at different time intervals for separately updating the road network information and point-of-interest information.
10. The system as defined in claim 1 wherein said database includes points of interest and wherein said operator-actuated switches permit the operator to selectively display the exits on a highway on which the vehicle is traveling, wherein said microprocessor is programmed to respond to operator input signals from said switches to provide a scroll-forward display of upcoming highway exits and for displaying points of interest accessible at such highway exits
11. The system as defined in claim 1 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest when on a highway and said display displays the distance and direction to said selected point of interest.
12. The system as defined in claim 1 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest and said display selectively displays detailed information regarding a selected point of interest.

13. The system as defined in claim 1 wherein said microprocessor allows the operator to select for individual display one of said addresses on a street on which the vehicle is traveling and cross-streets ahead and behind the vehicle.

14. The system as defined in claim 1 and further including an electronic compass coupled to said display.

15. The system as defined in claim 1 and further including an outside temperature sensor coupled to said display.

16. The system as defined in claim 1 and further including a trip computer coupled to said display.

17. A point-of-interest display system for a vehicle comprising:

- a current location detector for providing data representing the vehicle's current position;

- a database of information including points of interest and road network information including highway exits and local roadway street names and addresses;

- a microprocessor coupled to said detector and to said database for providing display output signals representing upcoming highway exit information as the vehicle proceeds along a highway to automatically provide point-of-interest information related to an exit, and when the vehicle exits a highway provide display output signals for displaying points of interest within a predetermined range from the current vehicle location;

- a display coupled to said microprocessor for displaying a predetermined number of points of interests within said predetermined range of the vehicle; and

- at least one operator-actuated switch coupled to said microprocessor to permit the operator to select a point of interest from a menu of available points of interest when on a highway or after exiting a highway to obtain detailed information regarding a selected point of interest.

18. The system as defined in claim 17 wherein said detector is a GPS receiver.

19. The system as defined in claim 17 wherein said point-of-interest information includes the categories of gas, food, and lodging and individual establishments within each category when available.

20. The system as defined in claim 17 wherein said database has data sets layered thereon according to road network information and point-of-interest information such that said memory can be updated separately at different time intervals for separately updating the road network information and point-of-interest information.

21. The system as defined in claim 17 wherein said database includes points of interest and wherein said operator-actuated switches permit the operator to selectively display the exits on a highway on which the vehicle is traveling, wherein said microprocessor is programmed to respond to operator input signals from said switches to provide a scroll-forward display of upcoming highway exits and for displaying points of interest accessible at such highway exits

22. The system as defined in claim 17 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest when on a highway and said display displays the distance and direction to said selected point of interest.

23. The system as defined in claim 17 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest after exiting a highway said display selectively displays detailed information regarding a selected point of interest.

24. The system as defined in claim 17 wherein said microprocessor allows the operator to select for individual display one of said addresses on a street on which the vehicle is traveling and cross-streets ahead and behind the vehicle.

1/13

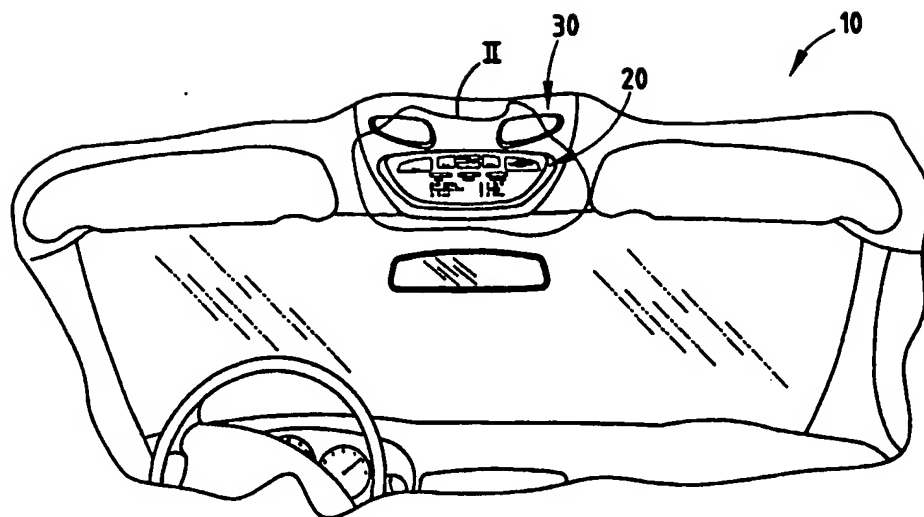


FIG. 1

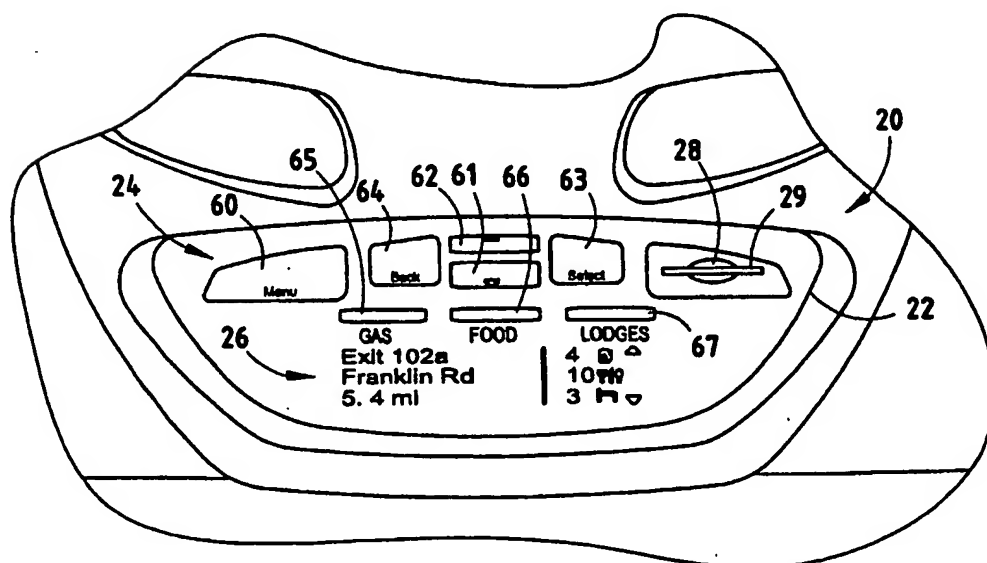


FIG. 2

2/13

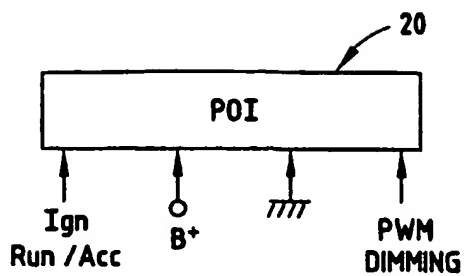


FIG. 3

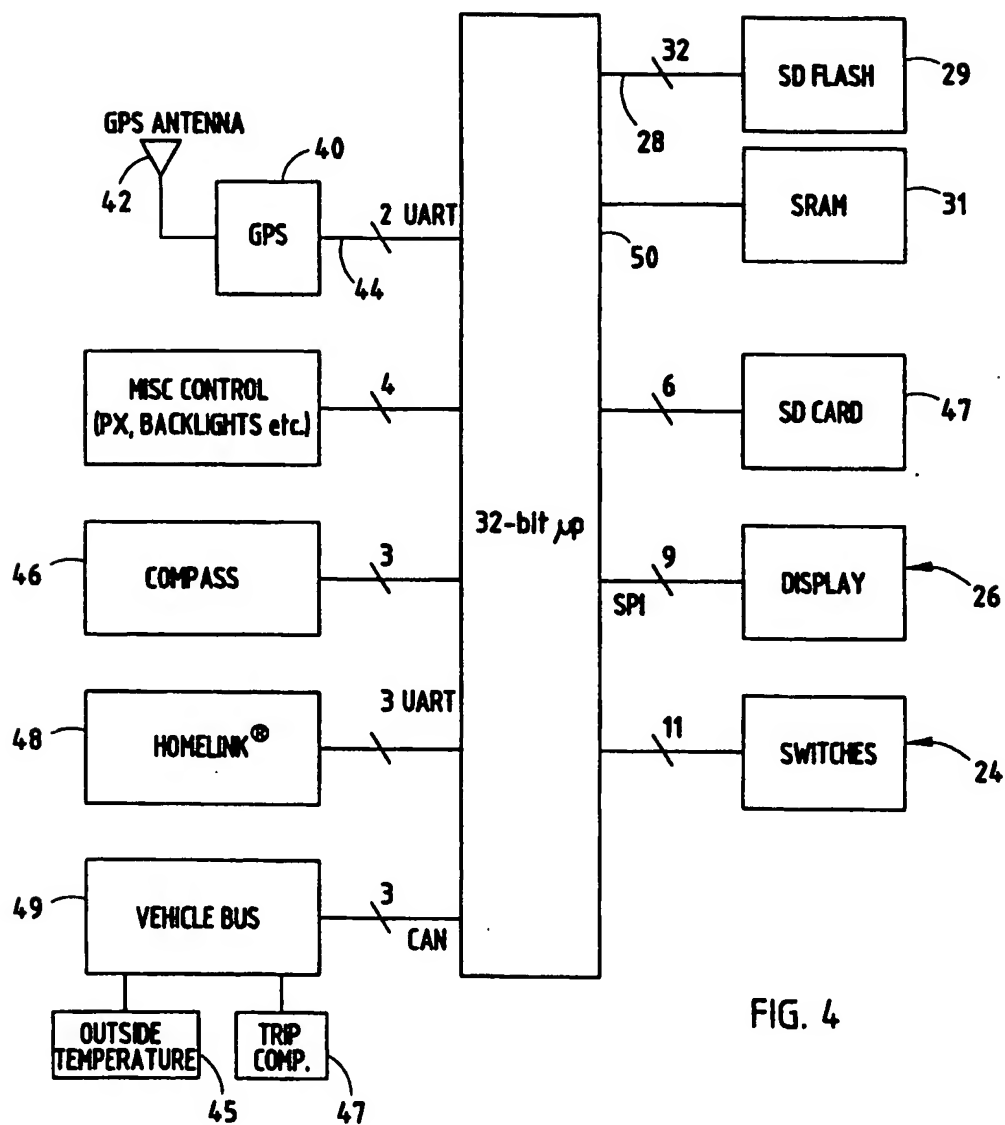


FIG. 4

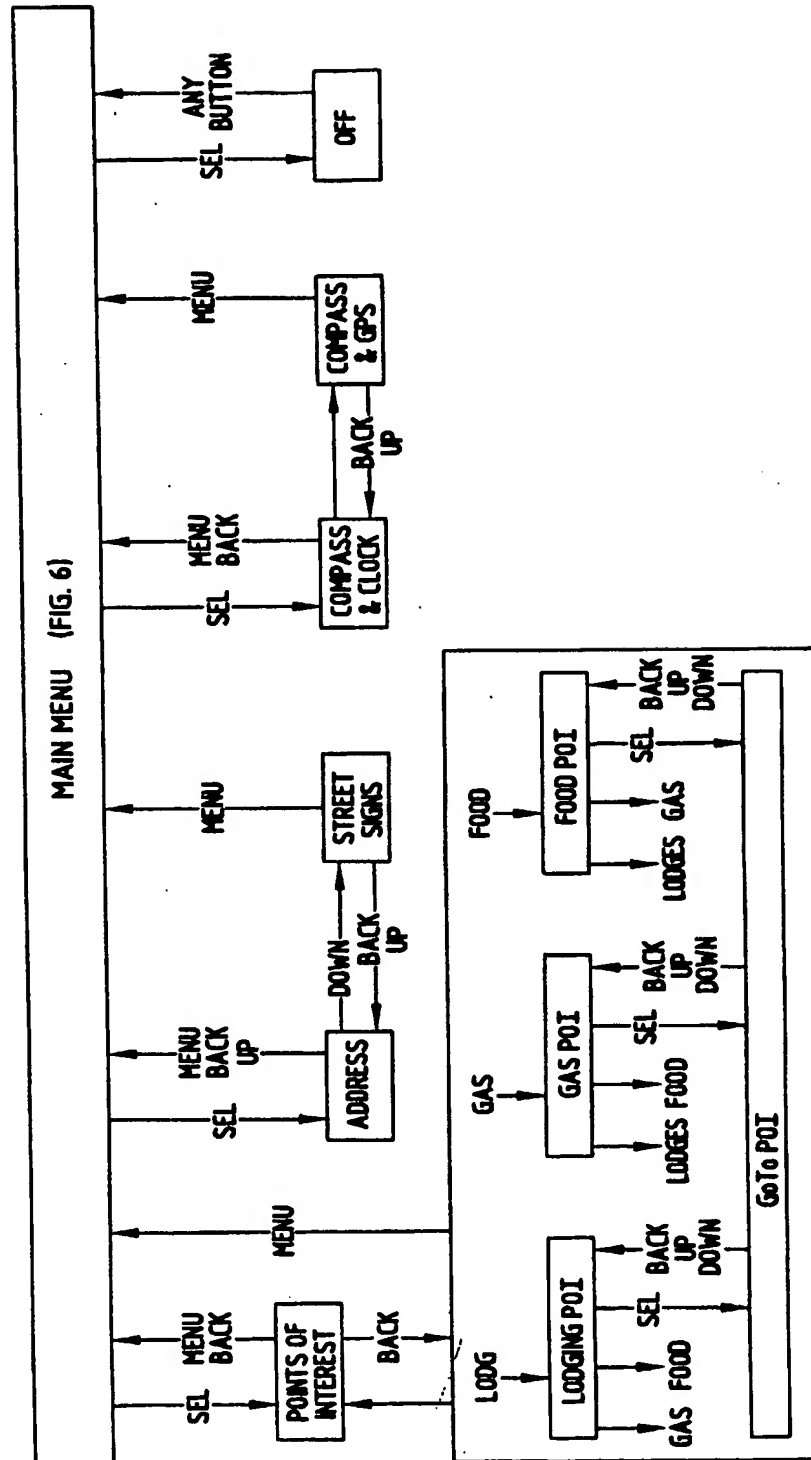


FIG. 5

4/13

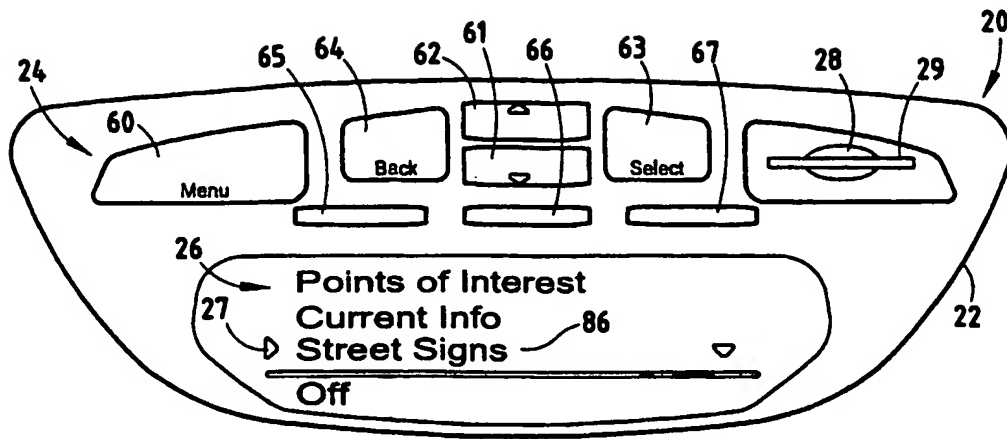


FIG. 6

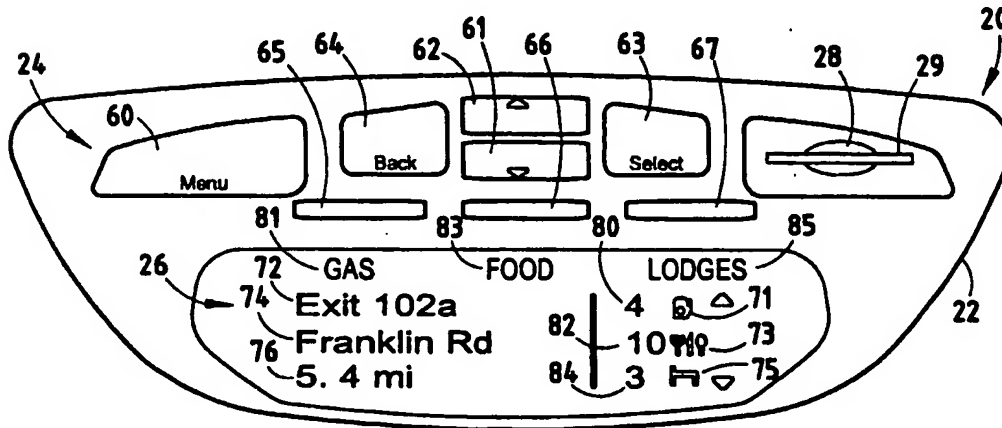


FIG. 7

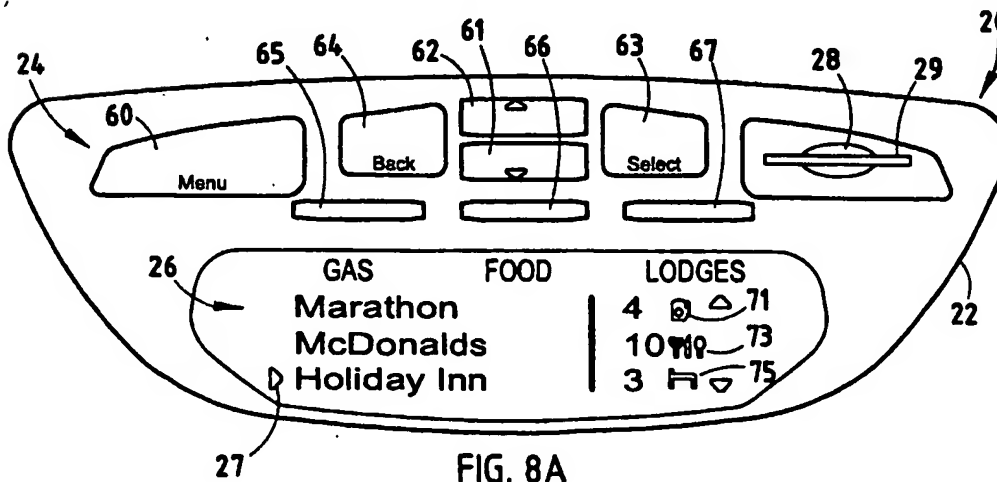


FIG. 8A

5/13

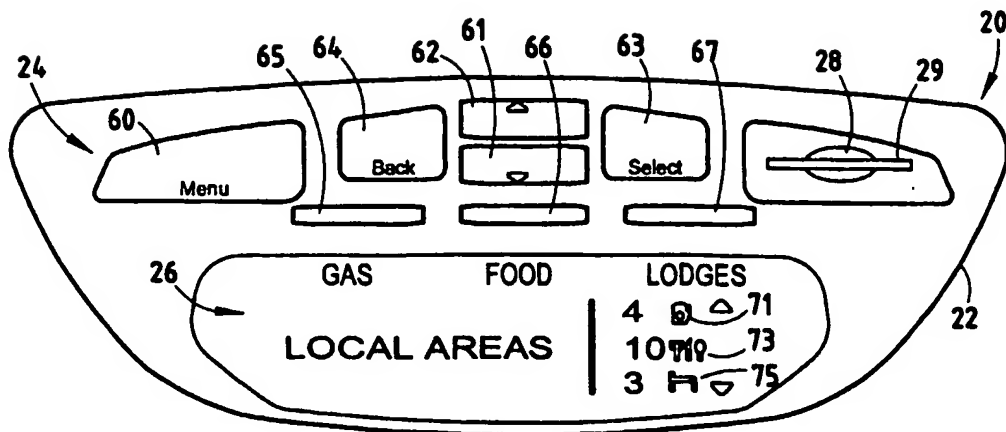


FIG. 8B

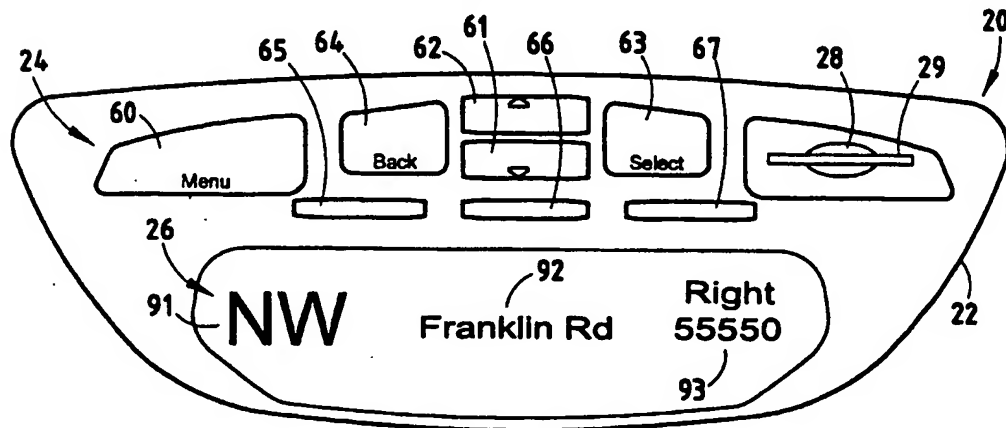


FIG. 9

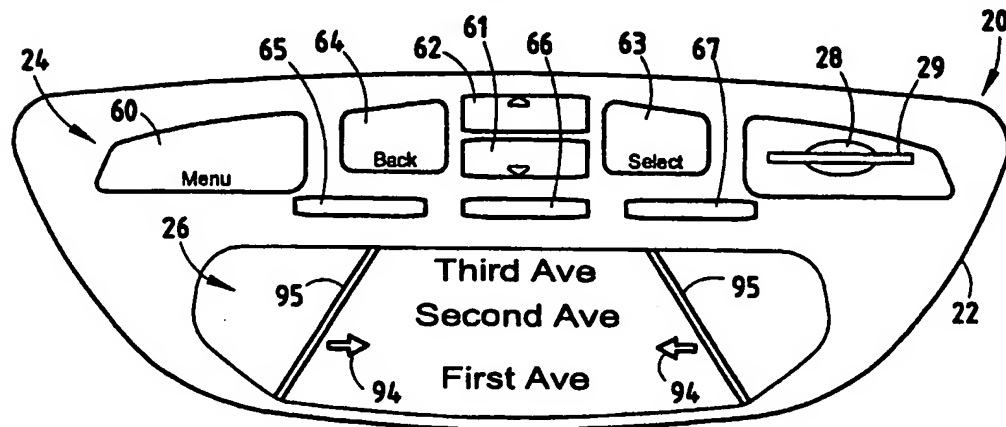


FIG. 10

6/13

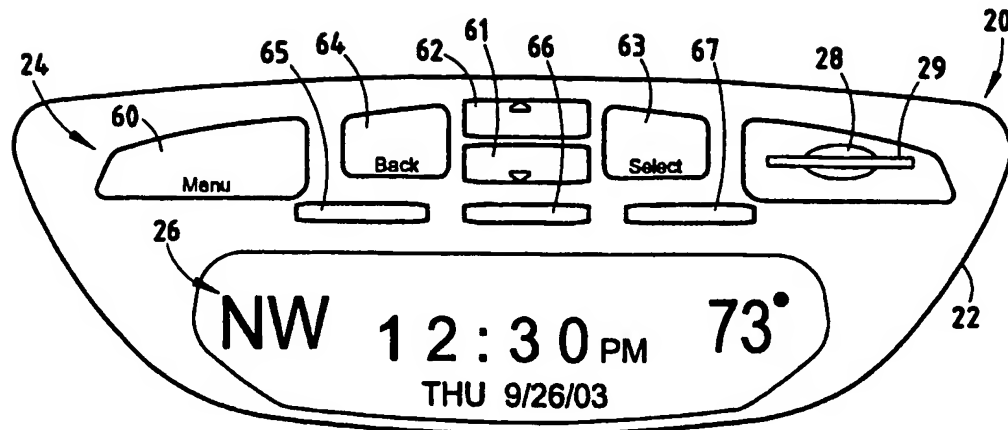


FIG. 11

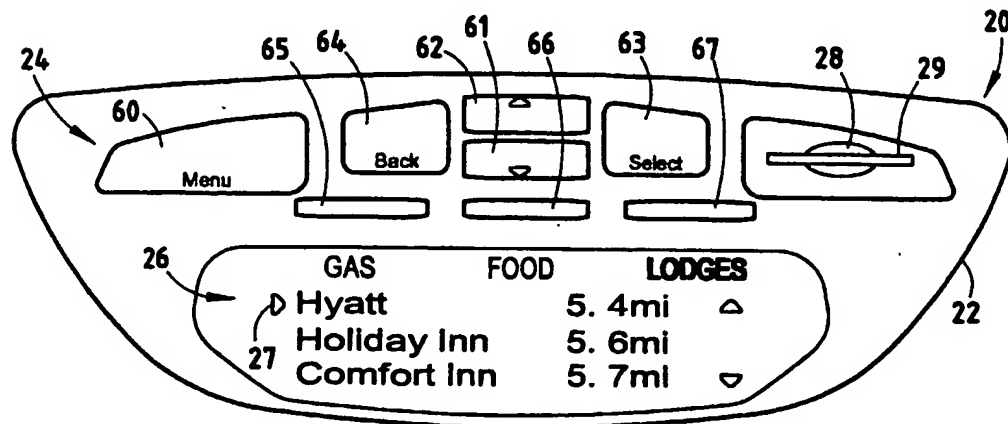


FIG. 12

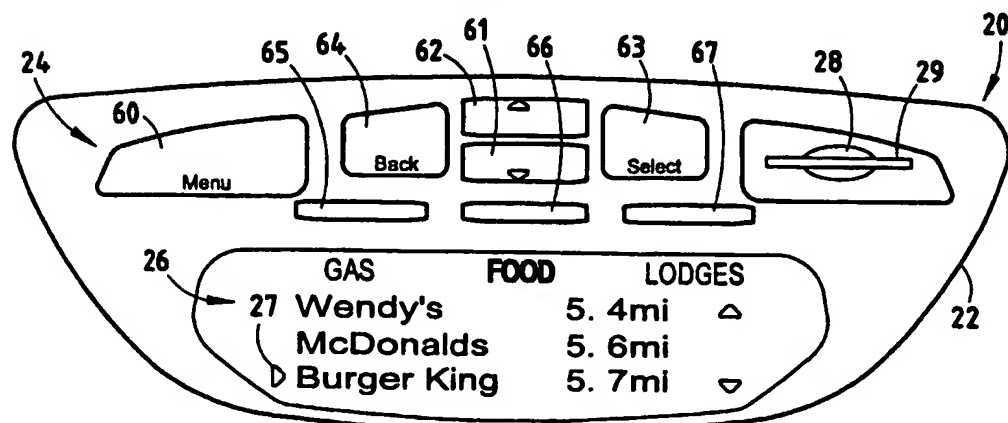


FIG. 13

7/13

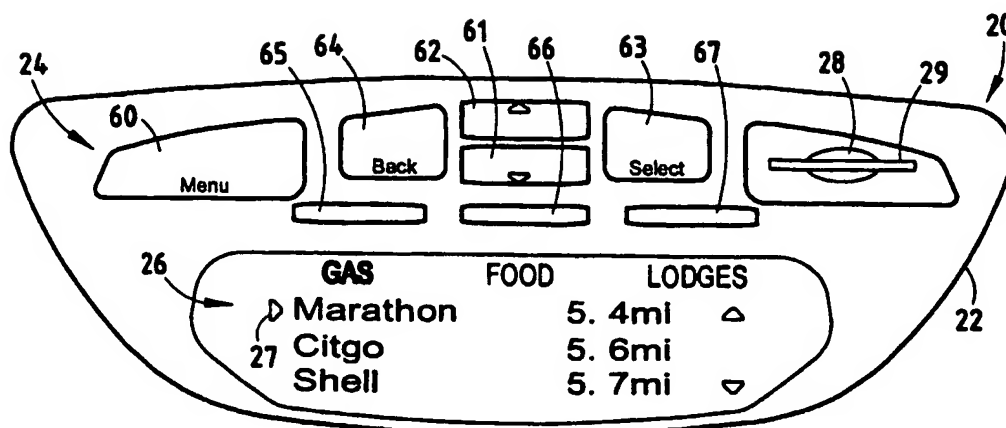


FIG. 14

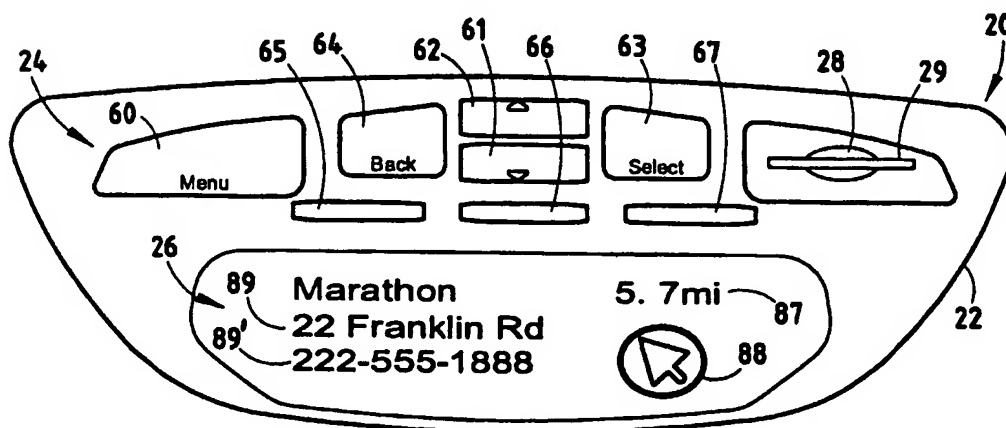


FIG. 15

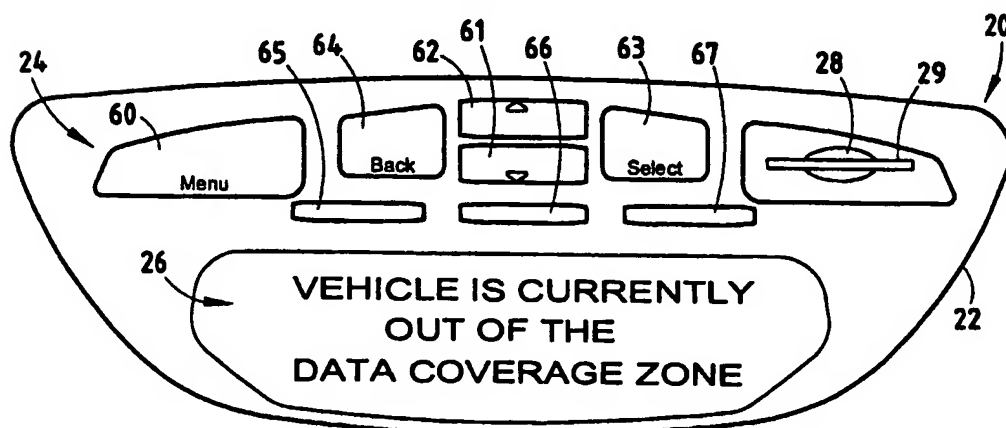


FIG. 16

8/13

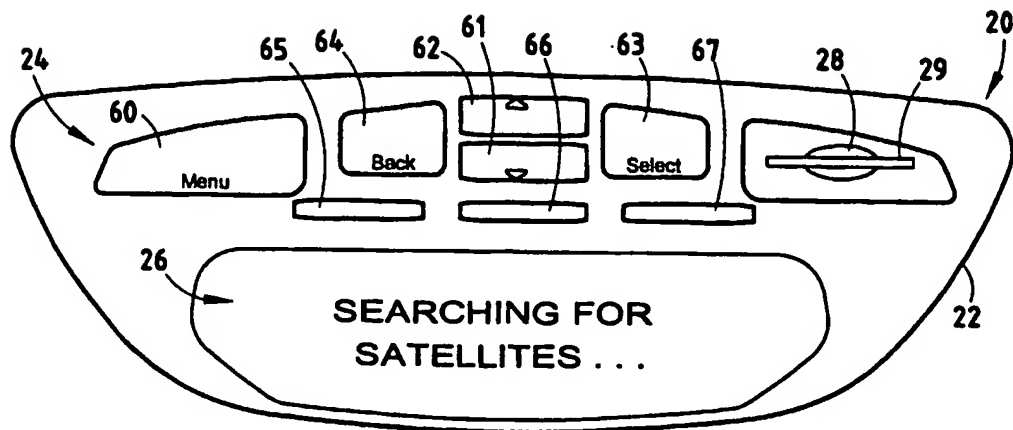


FIG. 17

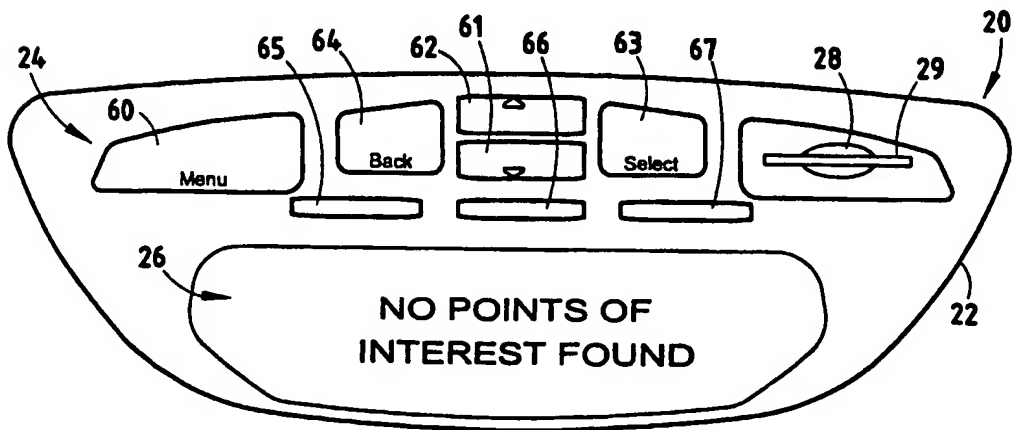


FIG. 18

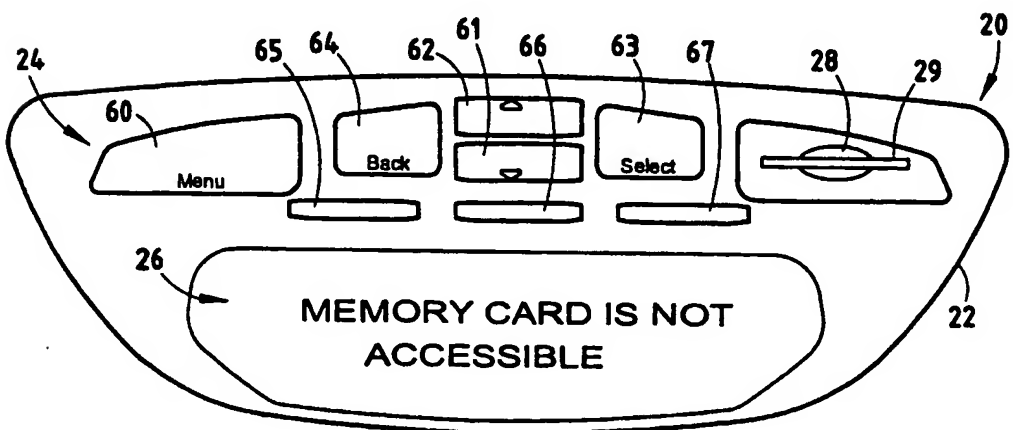


FIG. 19

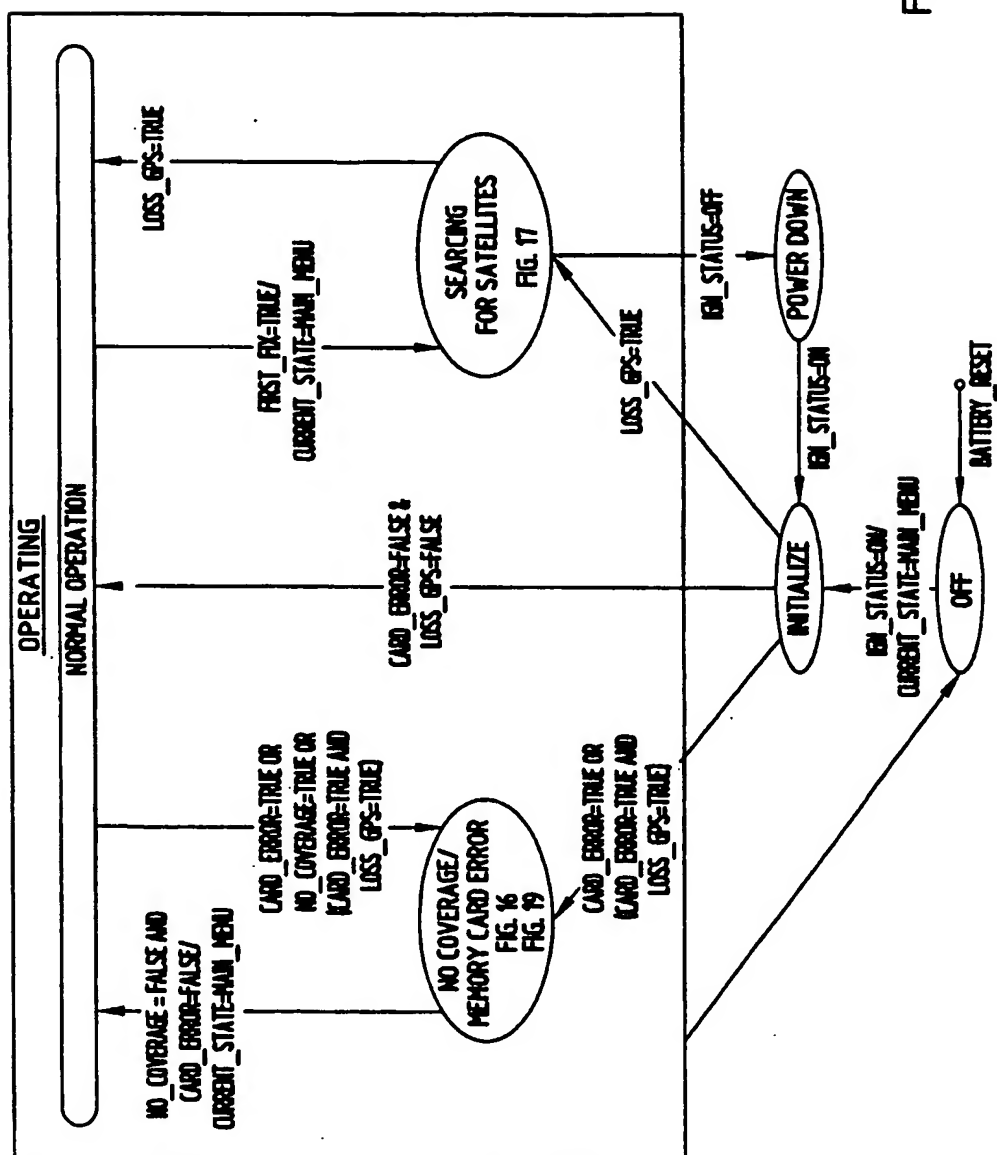


FIG. 20

10/13

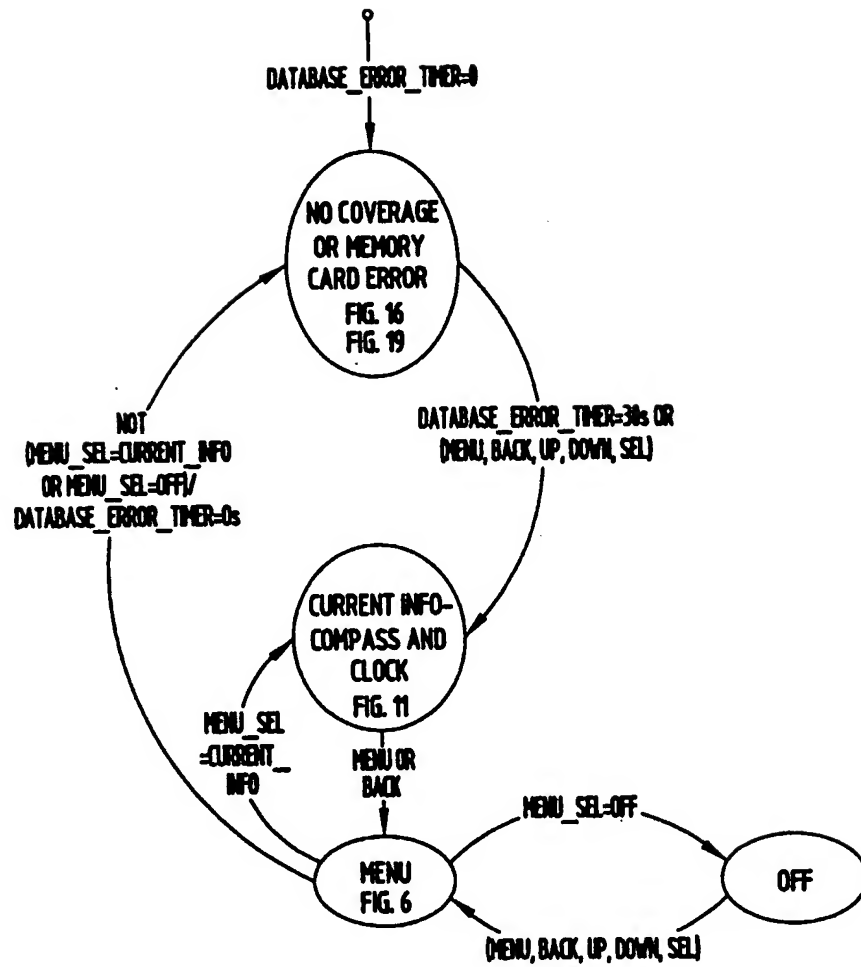


FIG. 21

11/13

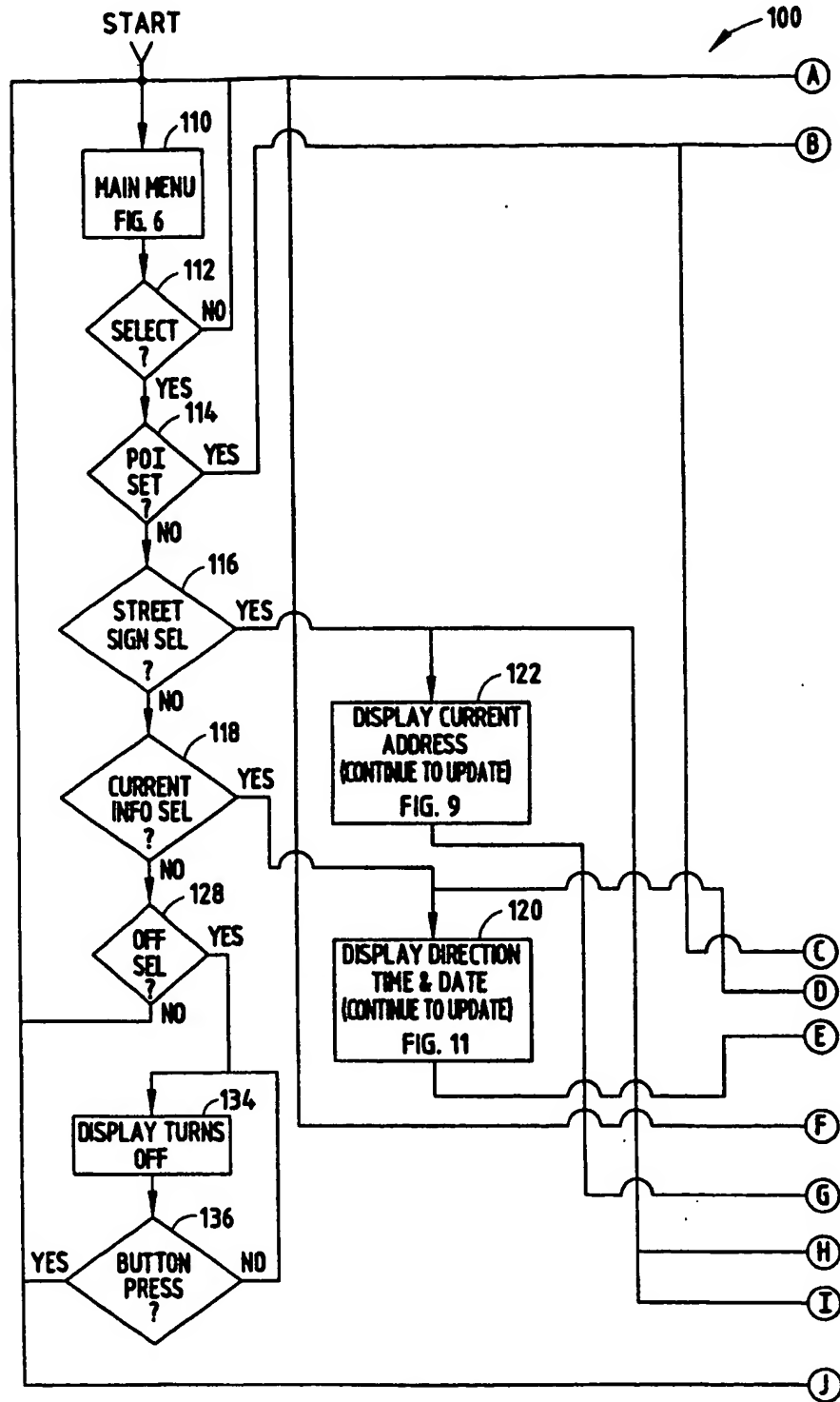


FIG. 22A

12/13

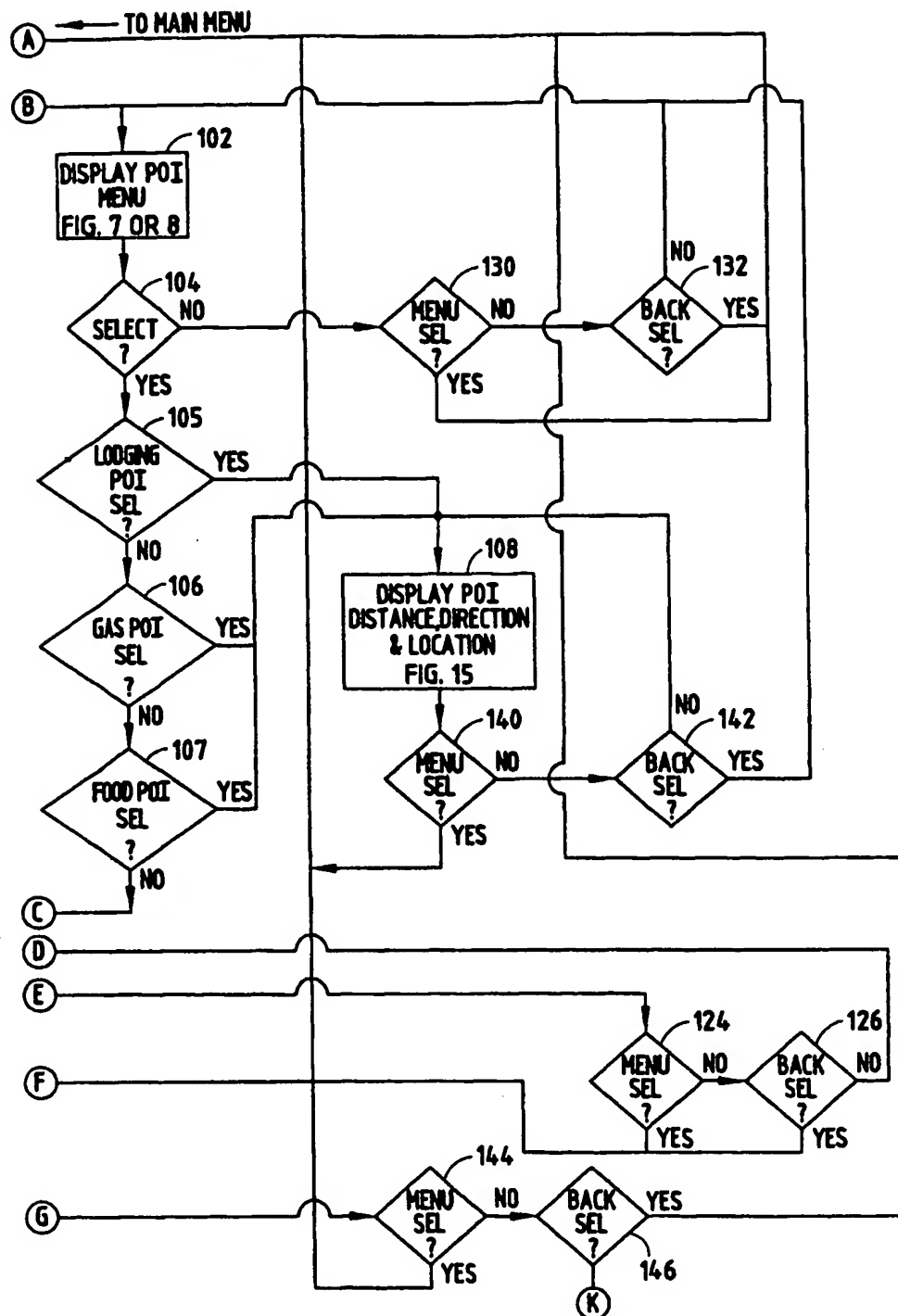


FIG. 22B

13/13

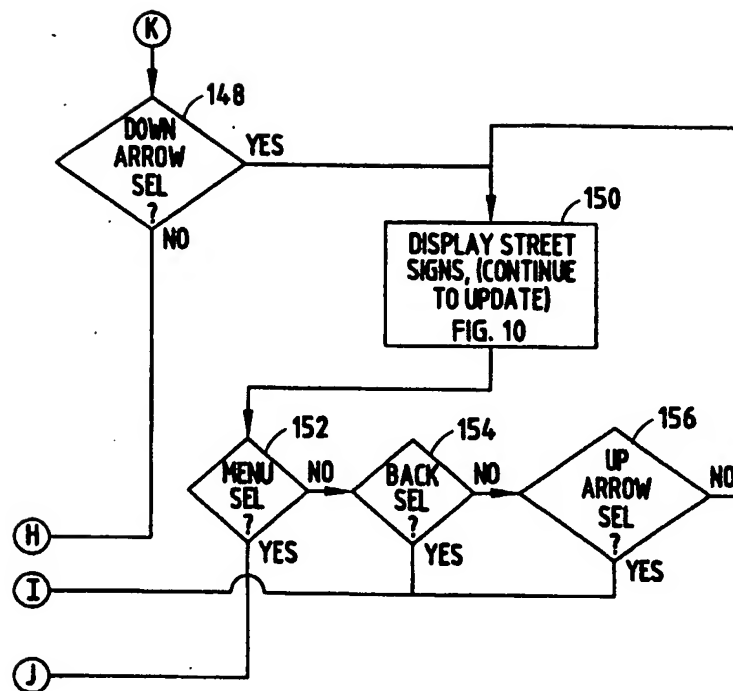


FIG. 22C

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original, first, and sole inventor (if only one inventor is named below) or an original, first, and joint inventor (if plural inventors are named below or in an attached Declaration) of the subject matter which is claimed and for which a patent is sought on the invention entitled

POINT-OF-INTEREST DISPLAY SYSTEM

(Attorney Docket No. 026032-4899)

the specification of which (check one)

 is attached hereto.

 X was filed on 10/20/2003 as United States Application Number or
PCT International Application Number 10/532,025
(PCT/US2003/033242).

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

THAT I do not know and do not believe that the same invention was first patented or made the subject of an inventor's certificate that issued in any country foreign to the United States of America before the filing date of this United States application if the foreign application was filed by me (us), or by my (our) legal representatives or assigns, more than twelve months (six months for design patents) prior to the filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified specification contains a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with

which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number	Country	Foreign Filing Date	Priority Claimed?	Certified Copy Attached?

I HEREBY CLAIM the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

U.S. Provisional Application Number	Filing Date
60/419,934	10/21/2002

I HEREBY CLAIM the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number

I HEREBY APPOINT the registered attorneys and agents at Customer Number

26371

to have full power to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent, and to transact all business in the United States Patent and Trademark Office connected therewith.


I request that all correspondence be directed to:

Jean M. Tibbetts
FOLEY & LARDNER LLP
Customer Number: 26371

Telephone: (414) 297-5531
Facsimile: (414) 297-4900

I UNDERSTAND AND AGREE THAT the foregoing attorneys and agents appointed by me to prosecute this application do not personally represent me or my legal interests, but instead represent the interests of the legal owner(s) of the invention described in this application.

I FURTHER DECLARE THAT all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Name of first inventor	Nisa M. Arnold-Huyser
Residence	Zeeland, Michigan
Citizenship	U.S.A.
Post Office Address	1520 Castlemaine Drive Zeeland, Michigan 49464
Inventor's signature	
Date	10/13/05

Name of second inventor	Alan S. Hughes
Residence	Holland, Michigan
Citizenship	U.S.A.
Post Office Address	1210 Birdie Lane Holland, Michigan 49423
Inventor's signature	
Date	

Name of third inventor	John S. Bambini
Residence	Kentwood, Michigan
Citizenship	U.S.A.
Post Office Address	5490 Brattleboro Drive, S.E. Kentwood, Michigan 49508
Inventor's signature	
Date	

Name of fourth inventor	Ian Milstead
Residence	Elmhurst, Illinois
Citizenship	U.S.A.
Post Office Address	665 Berkley Avenue Elmhurst, Illinois 60126-4201
Inventor's signature	
Date	

Name of fifth inventor	Susan K. Sondag
Residence	Holland, Michigan
Citizenship	U.S.A.
Post Office Address	2015 Woodlark Drive Holland, Michigan 49424
Inventor's signature	
Date	

ASSIGNMENT - WORLDWIDE

For good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, each undersigned inventor (hereinafter referred to singly and collectively as "ASSIGNOR") has sold, assigned, and transferred, and by these presents hereby sells, assigns, and transfers, unto

Johnson Controls Technology Company
915 East 32nd Street
Holland, Michigan 49423

(hereinafter referred to as "ASSIGNEE") its successors and assigns, the full and exclusive right, title and interest for the United States, its territories and possessions, and all foreign countries in and to this invention relating to

POINT-OF-INTEREST DISPLAY SYSTEM

as set forth in this United States Patent Application

check one ☐] executed concurrently herewith,
 ☐] executed on _____,
 ☒] Serial No. 10/532,025 Filed 04/21/2005

as well as in and to (a) all improvements and modifications of the above-identified invention or inventions, (b) the above-identified application and all other applications for Letters Patent of the United States and countries foreign thereto for above-identified invention or inventions and all improvements and modifications thereof, (c) all Letters Patent which may issue from said applications in the United States and countries foreign thereto, (d) all divisions, continuations, reissues, and extensions of said applications and Letters Patent, and (e) the right to claim for any of said applications the full benefits and priority rights under the International Convention and any other international agreement to which the United States adheres; such right, title, and interest to be held and enjoyed by ASSIGNEE, its successors and assigns, to the full end of the term or terms for which any and all such Letters Patent may be granted as fully and entirely as would have been held and enjoyed by ASSIGNOR had this Assignment not been made.

ASSIGNOR HEREBY AUTHORIZES ASSIGNEE to file patent applications in any or all countries on the above-identified invention or inventions in the name of the undersigned or in the name of ASSIGNEE or otherwise as ASSIGNEE may deem advisable under the International Convention or otherwise.

ASSIGNOR HEREBY AUTHORIZES AND REQUESTS the Commissioner of Patents and Trademarks to issue said Letters Patent to ASSIGNEE as assignee of the entire interest, for the sole use and benefit of ASSIGNEE, its successors and assigns.

ASSIGNOR HEREBY AGREES (a) to communicate to ASSIGNEE, its successors and assigns, or their representative or agents, all facts and information known or available to ASSIGNOR respecting said invention or inventions, improvements, and modifications including evidence for interference, reexamination, reissue, opposition, revocation, extension, or infringement purposes or other legal, judicial, or administrative proceedings, whenever requested by ASSIGNEE; (b) to testify in person or by affidavit as required by ASSIGNEE, its successors and assigns, in any such proceeding in the United States or a country foreign thereto; (c) to execute and deliver, upon request by ASSIGNEE, all lawful papers including, but not limited to, original, divisional, continuation, and reissue applications, renewals, assignments, powers of attorney, oaths, affidavits, and declarations, depositions; and (d) to provide all reasonable assistance to ASSIGNEE, its successors and assigns, in obtaining and enforcing proper title in and protection for said invention or inventions, improvements, and modifications under the intellectual property laws of the United States and countries foreign thereto.

ASSIGNOR HEREBY REPRESENTS AND WARRANTS that ASSIGNOR has the full and unencumbered right to sell, assign, and transfer the interests sold, assigned, and transferred herein, and that ASSIGNOR has not executed and will not execute any document or instrument in conflict herewith.

ASSIGNOR HEREBY GRANTS to the law firm of **Foley & Lardner LLP** the power and authority to insert in this Assignment any further identification which may be necessary or desirable to comply with the rules of the U.S. Patent and Trademark Office for recordation of this Assignment.

ASSIGNOR UNDERSTANDS AND AGREES that the attorneys and agents of the law firm of **Foley & Lardner LLP** do not personally represent ASSIGNOR OR ASSIGNOR's legal interests, but instead represent the interests of ASSIGNEE; since said attorneys and agents cannot provide legal advice to ASSIGNOR with respect to this Assignment, ASSIGNOR acknowledges its right to seek its own independent legal counsel.

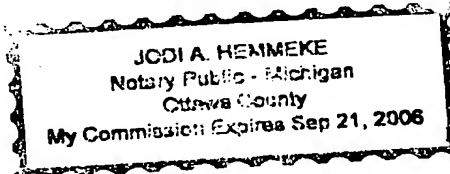
Executed this 13th day of October, 2005.

State of Michigan)
County of Ottawa)ss.

Nisa M. Arnold-Huyser
NISA M. ARNOLD-HUYSER

On this 13th day of October, 2005, before me, a notary public in and for said county, appeared NISA M. ARNOLD-HUYSER, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

(Seal)



Jodi A. Henneke
Notary Public
My Commission Expires: 09/21/06

Executed this _____ day of _____, 20____.

ALAN S. HUGHES

State of _____)
)ss.
County of _____)

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared ALAN S. HUGHES, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

Executed this _____ day of _____, 20____.

JOHN S. BAMBINI

Executed this _____ day of _____, 20____.

SUSAN K. SONDAY

State of _____)
)ss.
County of _____)

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared SUSAN K. SONDAY, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original, first, and sole inventor (if only one inventor is named below) or an original, first, and joint inventor (if plural inventors are named below or in an attached Declaration) of the subject matter which is claimed and for which a patent is sought on the invention entitled

POINT-OF-INTEREST DISPLAY SYSTEM

(Attorney Docket No. 026032-4900)

the specification of which (check one)

 is attached hereto.

 X was filed on 10/20/2003 as United States Application Number or PCT International Application Number 10/532,287 (PCT/US2003/033256) and was amended on (if applicable).

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

THAT I do not know and do not believe that the same invention was first patented or made the subject of an inventor's certificate that issued in any country foreign to the United States of America before the filing date of this United States application if the foreign application was filed by me (us), or by my (our) legal representatives or assigns, more than twelve months (six months for design patents) prior to the filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified specification contains a written description of the invention, and of the manner and process of making and using it, in such full, clear,

concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

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U.S. Provisional Application Number	Filing Date
60/419,934	10/21/2002

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U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number

I HEREBY APPOINT the registered attorneys and agents at Customer Number

26371

to have full power to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent, and to transact all business in the United States Patent and Trademark Office connected therewith.

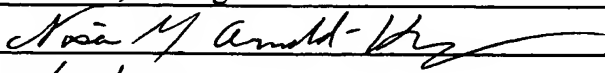
I request that all correspondence be directed to:

Jean M. Tibbetts
FOLEY & LARDNER LLP
Customer Number: 26371

Telephone: (414) 297-5531
Facsimile: (414) 297-4900

I UNDERSTAND AND AGREE THAT the foregoing attorneys and agents appointed by me to prosecute this application do not personally represent me or my legal interests, but instead represent the interests of the legal owner(s) of the invention described in this application.

I FURTHER DECLARE THAT all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Name of first inventor	Nisa M. Arnold-Huyser
Residence	Zeeland, Michigan
Citizenship	U.S.A.
Post Office Address	1520 Castlemaine Drive Zeeland, Michigan 49464
Inventor's signature	
Date	10/13/05

Name of second inventor	John S. Bambini
Residence	Kentwood, Michigan
Citizenship	U.S.A.
Post Office Address	5490 Brattleboro Drive, S.E. Kentwood, Michigan 49508
Inventor's signature	
Date	

Name of third inventor	Alan S. Hughes
Residence	Holland, Michigan
Citizenship	U.S.A.
Post Office Address	1210 Birdie Lane Holland, Michigan 49423
Inventor's signature	
Date	

Name of fourth inventor	Ian Milstead
Residence	Elmhurst, Illinois
Citizenship	U.S.A.
Post Office Address	665 Berkley Avenue Elmhurst, Illinois 60126-4201
Inventor's signature	
Date	

Name of fifth inventor

Susan K. Sondag

Residence

Holland, Michigan

Citizenship

U.S.A.

Post Office Address

2015 Woodlark Drive
Holland, Michigan 49424

Inventor's signature

Date

ASSIGNMENT - WORLDWIDE

For good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, each undersigned inventor (hereinafter referred to singly and collectively as "ASSIGNOR") has sold, assigned, and transferred, and by these presents hereby sells, assigns, and transfers, unto

Johnson Controls Technology Company
915 East 32nd Street
Holland, Michigan 49423

(hereinafter referred to as "ASSIGNEE") its successors and assigns, the full and exclusive right, title and interest for the United States, its territories and possessions, and all foreign countries in and to this invention relating to

POINT-OF-INTEREST DISPLAY SYSTEM

as set forth in this United States Patent Application

check one ☐ executed concurrently herewith,
 ☐ executed on _____,
 ☒ Serial No. 10/532,287 Filed 04/21/2005

as well as in and to (a) all improvements and modifications of the above-identified invention or inventions, (b) the above-identified application and all other applications for Letters Patent of the United States and countries foreign thereto for above-identified invention or inventions and all improvements and modifications thereof, (c) all Letters Patent which may issue from said applications in the United States and countries foreign thereto, (d) all divisions, continuations, reissues, and extensions of said applications and Letters Patent, and (e) the right to claim for any of said applications the full benefits and priority rights under the International Convention and any other international agreement to which the United States adheres; such right, title, and interest to be held and enjoyed by ASSIGNEE, its successors and assigns, to the full end of the term or terms for which any and all such Letters Patent may be granted as fully and entirely as would have been held and enjoyed by ASSIGNOR had this Assignment not been made.

ASSIGNOR HEREBY AUTHORIZES ASSIGNEE to file patent applications in any or all countries on the above-identified invention or inventions in the name of the undersigned or in the name of ASSIGNEE or otherwise as ASSIGNEE may deem advisable under the International Convention or otherwise.

ASSIGNOR HEREBY AUTHORIZES AND REQUESTS the Commissioner of Patents and Trademarks to issue said Letters Patent to ASSIGNEE as assignee of the entire interest, for the sole use and benefit of ASSIGNEE, its successors and assigns.

ASSIGNOR HEREBY AGREES (a) to communicate to ASSIGNEE, its successors and assigns, or their representative or agents, all facts and information known or available to ASSIGNOR respecting said invention or inventions, improvements, and modifications including evidence for interference, reexamination, reissue, opposition, revocation, extension, or infringement purposes or other legal, judicial, or administrative proceedings, whenever requested by ASSIGNEE; (b) to testify in person or by affidavit as required by ASSIGNEE, its successors and assigns, in any such proceeding in the United States or a country foreign thereto; (c) to execute and deliver, upon request by ASSIGNEE, all lawful papers including, but not limited to, original, divisional, continuation, and reissue applications, renewals, assignments, powers of attorney, oaths, affidavits, and declarations, depositions; and (d) to provide all reasonable assistance to ASSIGNEE, its successors and assigns, in obtaining and enforcing proper title in and protection for said invention or inventions, improvements, and modifications under the intellectual property laws of the United States and countries foreign thereto.

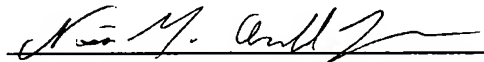
ASSIGNOR HEREBY REPRESENTS AND WARRANTS that ASSIGNOR has the full and unencumbered right to sell, assign, and transfer the interests sold, assigned, and transferred herein, and that ASSIGNOR has not executed and will not execute any document or instrument in conflict herewith.

ASSIGNOR HEREBY GRANTS to the law firm of **Foley & Lardner LLP** the power and authority to insert in this Assignment any further identification which may be necessary or desirable to comply with the rules of the U.S. Patent and Trademark Office for recordation of this Assignment.

ASSIGNOR UNDERSTANDS AND AGREES that the attorneys and agents of the law firm of **Foley & Lardner LLP** do not personally represent ASSIGNOR OR ASSIGNOR's legal interests, but instead represent the interests of ASSIGNEE; since said attorneys and agents cannot provide legal advice to ASSIGNOR with respect to this Assignment, ASSIGNOR acknowledges its right to seek its own independent legal counsel.

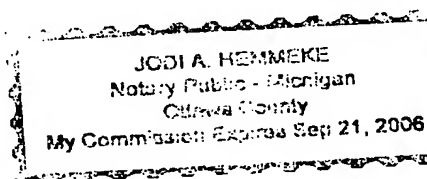
Executed this 13th day of October, 2005.


State of Michigan)
County of Ottawa)ss.


NISA M. ARNOLD-HUYSER

On this 13th day of October, 2005, before me, a notary public in and for said county, appeared NISA M. ARNOLD-HUYSER, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

(Seal)




Notary Public
My Commission Expires: 09/21/06

Executed this _____ day of _____, 20____.

JOHN S. BAMBINI

Executed this ____ day of _____, 20__.

ALAN S. HUGHES

State of _____)
County of _____)ss.

On this ____ day of _____, 20__, before me, a notary public in and for said county, appeared ALAN S. HUGHES, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

Executed this _____ day of _____, 20____.

IAN MILSTEAD

State of _____)
County of _____)ss.

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared IAN MILSTEAD, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

Executed this _____ day of _____, 20____.

SUSAN K. SONDAY

State of _____)
)ss.
County of _____)

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared SUSAN K. SONDAY, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original, first, and sole inventor (if only one inventor is named below) or an original, first, and joint inventor (if plural inventors are named below or in an attached Declaration) of the subject matter which is claimed and for which a patent is sought on the invention entitled

POINT OF INTEREST DISPLAY SYSTEM

(Attorney Docket No. 026032-4901)

the specification of which (check one)

___ is attached hereto.

X was filed on 10/20/2003 as United States Application Number or PCT International Application Number 10/532,199 (PCT/US2003/033284) and was amended on ___ (if applicable).

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

THAT I do not know and do not believe that the same invention was first patented or made the subject of an inventor's certificate that issued in any country foreign to the United States of America before the filing date of this United States application if the foreign application was filed by me (us), or by my (our) legal representatives or assigns, more than twelve months (six months for design patents) prior to the filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified specification contains a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with

which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number	Country	Foreign Filing Date	Priority Claimed?	Certified Copy Attached?

I HEREBY CLAIM the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

U.S. Provisional Application Number	Filing Date
60/419934	10/21/2002

I HEREBY CLAIM the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number
	PCT/US2003/033284	10/20/2003	

I HEREBY APPOINT the registered attorneys and agents at Customer Number

26371

to have full power to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent, and to transact all business in the United States Patent and Trademark Office connected therewith.

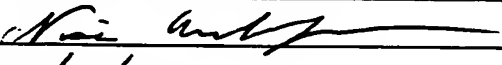
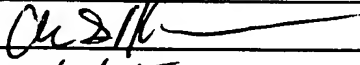
I request that all correspondence be directed to:

Jean M. Tibbetts
FOLEY & LARDNER LLP
Customer Number: 26371

Telephone: (414) 297-5531
Facsimile: (414) 297-4900

I UNDERSTAND AND AGREE THAT the foregoing attorneys and agents appointed by me to prosecute this application do not personally represent me or my legal interests, but instead represent the interests of the legal owner(s) of the invention described in this application.

I FURTHER DECLARE THAT all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Inventor's signature	
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Date	10/10/05
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Inventor's signature	
Date	
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Inventor's signature	
Date	

Name of fifth inventor

Susan K. Sondag

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Inventor's signature

Date

ASSIGNMENT - WORLDWIDE

For good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, each undersigned inventor (hereinafter referred to singly and collectively as "ASSIGNOR") has sold, assigned, and transferred, and by these presents hereby sells, assigns, and transfers, unto

Johnson Controls Technology Company
915 East 32nd Street
Holland, Michigan 49423

(hereinafter referred to as "ASSIGNEE") its successors and assigns, the full and exclusive right, title and interest for the United States, its territories and possessions, and all foreign countries in and to this invention relating to

POINT OF INTEREST DISPLAY SYSTEM

as set forth in this United States Patent Application

check one ☐ executed concurrently herewith,
 ☐ executed on _____,
 ☒ Serial No. 10/532,199 Filed 04/21/2005

as well as in and to (a) all improvements and modifications of the above-identified invention or inventions, (b) the above-identified application and all other applications for Letters Patent of the United States and countries foreign thereto for above-identified invention or inventions and all improvements and modifications thereof, (c) all Letters Patent which may issue from said applications in the United States and countries foreign thereto, (d) all divisions, continuations, reissues, and extensions of said applications and Letters Patent, and (e) the right to claim for any of said applications the full benefits and priority rights under the International Convention and any other international agreement to which the United States adheres; such right, title, and interest to be held and enjoyed by ASSIGNEE, its successors and assigns, to the full end of the term or terms for which any and all such Letters Patent may be granted as fully and entirely as would have been held and enjoyed by ASSIGNOR had this Assignment not been made.

ASSIGNOR HEREBY AUTHORIZES ASSIGNEE to file patent applications in any or all countries on the above-identified invention or inventions in the name of the undersigned or in the name of ASSIGNEE or otherwise as ASSIGNEE may deem advisable under the International Convention or otherwise.

ASSIGNOR HEREBY AUTHORIZES AND REQUESTS the Commissioner of Patents and Trademarks to issue said Letters Patent to ASSIGNEE as assignee of the entire interest, for the sole use and benefit of ASSIGNEE, its successors and assigns.

ASSIGNOR HEREBY AGREES (a) to communicate to ASSIGNEE, its successors and assigns, or their representative or agents, all facts and information known or available to ASSIGNOR respecting said invention or inventions, improvements, and modifications including evidence for interference, reexamination, reissue, opposition, revocation, extension, or infringement purposes or other legal, judicial, or administrative proceedings, whenever requested by ASSIGNEE; (b) to testify in person or by affidavit as required by ASSIGNEE, its successors and assigns, in any such proceeding in the United States or a country foreign thereto; (c) to execute and deliver, upon request by ASSIGNEE, all lawful papers including, but not limited to, original, divisional, continuation, and reissue applications, renewals, assignments, powers of attorney, oaths, affidavits, and declarations, depositions; and (d) to provide all reasonable assistance to ASSIGNEE, its successors and assigns, in obtaining and enforcing proper title in and protection for said invention or inventions, improvements, and modifications under the intellectual property laws of the United States and countries foreign thereto.

ASSIGNOR HEREBY REPRESENTS AND WARRANTS that ASSIGNOR has the full and unencumbered right to sell, assign, and transfer the interests sold, assigned, and transferred herein, and that ASSIGNOR has not executed and will not execute any document or instrument in conflict herewith.

ASSIGNOR HEREBY GRANTS to the law firm of **Foley & Lardner LLP** the power and authority to insert in this Assignment any further identification which may be necessary or desirable to comply with the rules of the U.S. Patent and Trademark Office for recordation of this Assignment.

ASSIGNOR UNDERSTANDS AND AGREES that the attorneys and agents of the law firm of **Foley & Lardner LLP** do not personally represent ASSIGNOR OR ASSIGNOR's legal interests, but instead represent the interests of ASSIGNEE; since said attorneys and agents cannot provide legal advice to ASSIGNOR with respect to this Assignment, ASSIGNOR acknowledges its right to seek its own independent legal counsel.

Executed this _____ day of _____, 20__.

NISA M. ARNOLD-HUYSER

State of _____)
)ss.
County of _____)

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared NISA M. ARNOLD-HUYSER, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

Executed this _____ day of _____, 20____.

ALAN S. HUGHES

State of _____)
)ss.
County of _____)

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared ALAN S. HUGHES, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

Executed this ____ day of _____, 20__.

JOHN S. BAMBINI

Executed this ____ day of _____, 20__.

IAN MILSTEAD

Executed this _____ day of _____, 20____.

SUSAN K. SONDAY

State of _____)
County of _____)ss.

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared SUSAN K. SONDAY, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

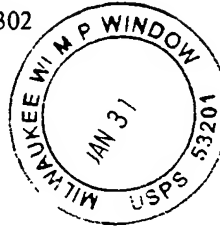
7160 3901 9849 6402 1183

TO: Mr. John S. Bambini
5490 Brattleboro Dr. SE
Kentwood, MI 49508-6302

ST CLAIR

SENDER: NSTC

REFERENCE: 026032-4899



PS Form 3800, January 2005

RETURN RECEIPT SERVICE	Postage	4.00
	Certified Fee	1.25
	Return Receipt Fee	
	Restricted Delivery	0.00
	Total Postage & Fees	5.25 0.00

US Postal Service
**Receipt for
Certified Mail**

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OF RETURN ADDRESS. FOLD AT DOTTED LINE

CERTIFIED MAIL

2. Article Number



7160 3901 9849 6402 1183

3. Service Type **CERTIFIED MAIL**4. Restricted Delivery? (Extra Fee) ☐ Yes

1. Article Addressed to:

Mr. John S. Bambini
5490 Brattleboro Dr. SE
Kentwood, MI 49508-6302

COMPLETE THIS SECTION ON DELIVERY

A. Received by (Please Print Clearly)

B. Date of Delivery

Meghan Bambini 10-2-07

C. Signature

*Meghan Bambini

☐ Agent
☒ Addressee

D. Is delivery address different from item 1?
If YES, enter delivery address below:

☐ Yes
☒ No

Nate St. Clair II

10

NSTC

026032-4899

PS Form 3811, January 2005

Domestic Return Receipt

EXHIBIT H**Reichenberger, Karl F.**

From: St. Clair, Nathaniel
Sent: Wednesday, January 31, 2007 10:19 AM
To: 'John.Bambini@smiths-aerospace.com'
Cc: Reichenberger, Karl F.
Subject: Assignments and Declarations and Power of Attorney for Patent Applications
Attachments: U.S. Patent Application (F&L 026032-4899) (FILED 04-21-2005).pdf; U.S. Patent Application (F&L 026032-4901) (FILED 04-21-2005).pdf; U.S. Patent Application (F&L 026032-4900) (FILED 04-21-2005).pdf; Assignment and Declaration - 4901.pdf; Assignment and Declaration - 4899.pdf; Assignment and Declaration - 4900.pdf; employee_agreement.pdf

Re: Assignments & Declarations and Power of Attorney for Patent Applications
Applicant: Arnold-Huyser et al.
Title: POINT-OF-INTEREST DISPLAY SYSTEM
Filing Date: April 21, 2005
F&L File Nos.: 026032-4899, 026032-4900, 026032-4901

Dear Mr. Bambini:

I represent Johnson Controls, Inc. ("JCI"), in the above-referenced patent matters. I have attempted to contact you on multiple occasions to remind you of your obligations to JCI, regarding the execution of certain necessary papers for the above-referenced patent matters.

Per the attached document entitled "Employee Innovation and Non-Disclosure Agreement," you entered into an agreement with Prince Corporation (now owned by JCI) to execute "all necessary papers and provide proper assistance during or subsequent to your employment, to enable the company to obtain for itself patents, copyrights, or other legal protection for such inventions or innovations."

I have also attached the necessary papers for you to execute, including the (i) Assignments and (ii) Declarations and Power of Attorney for each of the above-referenced patent applications, in order for you to comply with your contractual obligations to JCI. I have also enclosed complete copies of the patent applications, including the specification, claims, and drawings. Your immediate attention and return of the executed documents via facsimile prior to **Wednesday, February 7, 2007**, would be greatly appreciated. The originals should be returned via mail courier soon thereafter. If you have any questions regarding the content of this letter or any other communication(s) regarding this matter, please do not hesitate to contact me.

Best regards,

Nathaniel St. Clair II

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1/31/2007

POINT-OF-INTEREST DISPLAY SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a display system for a vehicle and particularly to one which provides a display of selected names of points of interest arranged by category and elemental directions to a selected point of interest. One embodiment provides a graphic display of cross-streets or addresses as the vehicle travels along a local roadway.

There exist numerous vehicle navigation systems which provide graphic map displays, which allow the vehicle operator, through significant manipulation of controls, to plan a travel route and obtain information about arrival destinations, typically by address. Some systems provide navigation control through the use of voice recognition programs and control circuits. All of these systems are relatively expensive, complicated and difficult for a vehicle operator to utilize, particularly when preoccupied with surrounding traffic in congested areas. Some suggested simplified navigation systems allow the vehicle operator to either identify his or her current location by street address and forthcoming intersection information, as well as basic points of interest information. Such systems are relatively inexpensive but do not provide the operator with the flexibility of providing points-of-interest information in a user-friendly format nor additional desirable features, such as easily accessible alternate displays of forthcoming highway exits, street intersections, or street addresses when traveling on a local street.

Thus, there remains a need for a display system for a vehicle which is relatively inexpensive and is user-friendly to operate using a minimum number of intuitive controls. Such a system needs to provide desirable features, such as points of interest in selected categories which can be easily accessed with minimal operator intervention and yet provide the operator with sufficient information to be able to locate and travel to such points-of-interest.

SUMMARY OF THE INVENTION

The system of the present invention satisfies this need by providing a point-of-interest display system in which an updateable database includes road network information, which can be updated at relatively infrequent time intervals, and point-of-

interest information which can be user-updated at more frequent intervals, as new points of interest become available. In a preferred embodiment of the invention, the database is carried on the vehicle in the form of a flashcard or other removable memory device or loaded into flash memory residing in the vehicle via a data communication system. The database interfaces with a microprocessor on the vehicle which receives data from a current position detector, such as a GPS receiver, providing the system with current vehicle location and direction of travel information. A display provides the operator textural and elemental graphic display information, and one or more control switches are positioned in an easily accessible location within the vehicle such that the operator, by scrolling through displayed highway exits, can select categories of points of interest, and points of interest within a category upon the actuation of a minimal number of switches in an intuitive sequence.

In one embodiment of the invention, two modes of operation provide point-of-interest information either while the vehicle is traveling on a limited access highway or, once the vehicle has exited the highway, provides more specific point-of-interest directions. In another embodiment of the invention, the operator can, when on a local road, select the textural display of forthcoming and past intersecting streets, which is updated as the vehicle travels along the roadway. In yet another embodiment of the invention, the navigation system provides a display of the street addresses on which the vehicle is traveling and increments, decrements, or otherwise updates the address as the vehicle moves. In a preferred embodiment of the invention, each of these features are incorporated in a system which allows selection between the features, either manually or automatically as the vehicle moves between a limited access highway and a local roadway.

These and other features, objects and advantages of the present invention will become apparent upon reading the following description thereof together with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a fragmentary perspective view of a vehicle having a point-of-interest display system embodying the present invention;

Fig. 2 is an enlarged fragmentary view of the system shown in Fig. 1;

Fig. 3 is a block electrical diagram showing one interface connection of the system to the vehicle power system;

Fig. 4 is a block electrical circuit diagram of the point-of-interest system including its major components;

Fig. 5 is a flow diagram showing the menu operation for operation of the system shown in Figs. 1-4;

Fig. 6 is the display screen for the main menu;

Fig. 7 is the display screen illustrating the information displayed to the vehicle operator when in a highway point-of-interest mode of operation;

Figs. 8A and 8B are alternate display screens illustrating the information displayed to the vehicle operator when in a local point-of-interest mode of operation;

Fig. 9 is the display screen illustrating the information displayed to the vehicle operator when in a street-address mode of operation;

Fig. 10 is the display screen illustrating the information displayed to the vehicle operator when in a street-sign or cross-street mode of operation;

Fig. 11 is the display screen illustrating the information displayed to the vehicle operator when in a current-information mode of operation;

Fig. 12 is the display screen illustrating the information displayed to the vehicle operator when the lodging category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 13 is the display screen illustrating the information displayed to the vehicle operator when the food category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 14 is the display screen illustrating the information displayed to the vehicle operator when the gas category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 15 is the display screen illustrating the information displayed to the vehicle operator when a particular point of interest in the highway mode has been selected;

Fig. 16 is the display screen illustrating the information displayed to the vehicle operator when the vehicle is out of the coverage zone;

Fig. 17 is the display screen illustrating the information displayed to the vehicle operator during initial start up when the GPS receiver is looking for satellites;

Fig. 18 is the display screen illustrating the information displayed to the vehicle operator when no point of interest was found at a selected exit;

Fig. 19 is the display screen illustrating the information displayed to the vehicle operator in the event a memory card has not been inserted into the circuit;

Fig. 20 is a flow diagram of the operation of the system during start up and shut down;

Fig. 21 is a flow diagram of the normal operation mode of the system; and

Figs. 22A, 22B, and 22C are a detailed flow diagram of the programming of the system during operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring initially to Fig. 1, there is shown a vehicle 10, such as an automobile, van, sports utility vehicle, truck, or the like, which incorporates a point-of-interest display system of one embodiment of the present invention. The point-of-interest display system 20 is mounted in one embodiment in an overhead console 30, although it can be mounted at any conveniently accessible location within easy reach of the vehicle operator, such as in the instrument panel. The point-of-interest system includes a switch group 24 and a display section 26, shown in detail in Fig. 2. The point-of-interest system can be mounted within a housing 22, which includes both the display 26 and switch section 24, as well as a memory card slot 28 for receiving a removable memory card 29, such as a flashcard on which the point-of-interest and road network data is programmed. Alternatively, separate mounting of the components is possible.

The memory card 29 typically will be at least a 128 meg card, although 256 or 512 meg cards may be preferred. The memory card is removable from slot 28, such that data thereon, including road network information and point-of-interest (POI) information, can be separately programmed in layers thereon, such that the road network and POI data can be refreshed at different, periodic intervals. Memory card 29 includes nonvolatile memory and contains a handshake code to communicate with a microprocessor 50 (Fig. 4) of the system, so the microprocessor can read data on the memory card 29. The system, as seen in Fig. 4, also includes a programmable SRAM memory 31, which contains the program for the sequential operation of the system, as shown in Fig. 5. The flow diagram for the program is shown in Figs. 22A, 22B, and 22C, described below. In one embodiment memory card 29 can be obtained from a car

dealer with an update subscription service for refreshing the data on the card either annually, in the case of road network information, or more frequently as new points of interest may become available, such as, for example, on a monthly basis. Alternatively, the user may subscribe to a web site providing download information for refreshing the data on memory card 29 on a personal computer if desired. Card 29 may also be updated through other means. Typically, the memory card will have data sufficient for a regional area in which the vehicle normally travels and will contain points of interest according to categories, such as gas, food, and lodging, as well as all the major (*i.e.*, limited access) and secondary road identifications and street addresses for secondary roads.

The map database is composed of at least two layers, at least one of which includes data like points of interest that change frequently. It is, therefore, desirable to update this information frequently. Another layer or layers of data contain information like the road network that may be undated less frequently. The data layers are linked and each layer may be updated either independently or in combination with other layers. This allows the consumer to obtain updated information without excessive download time when refreshing the data through the Internet, since the update can be limited to the part of the data that changes frequently.

Each layer is contained within a single file on the flashcard 29 for a given geographical area. Every POI record, whether for highway or local coverage, references a street name record in the road network file. This reference is stored in the POI file as an index into the street name table in the road network file.

As the latest POI information is released and compiled, every POI file that is created is associated with the latest road network file available. In addition, any new points of interest that are associated with roads that are not yet compiled into the latest road network file are added to the POI file but are flagged as being without a street name. All other POI attributes, such as telephone number, latitude/longitude and name, are still available in this case. Details of some aspects of the programming of the system to provide the various modes of operation are disclosed in Application No. 60/419,934, entitled **SYSTEM AND METHOD FOR DISPLAYING VEHICLE LOCATION AND POINT OF INTEREST INFORMATION**, the disclosure of which is incorporated herein by reference and in connection with the flow diagrams of Figs. 22A-22C.

The system, as best seen in Fig. 4, includes a current location detection device, such as GPS receiver 40, having an antenna 42 for receiving global positioning satellite signals from multiple satellites and providing current location data to one or more microprocessor(s) 50, which can be a Motorola MC9512DJ64 or its equivalent, through a universal asynchronous receiver/transmitter connection 44. Other current location detection sources of data, such as a Loran receiver, gyro compass, or dead reckoning information sources, may also be employed but a GPS receiver represents the current best mode of receiving such data. The microprocessor receives vehicle location data from the GPS receiver and point-of-interest and road network data from the flashcard 29, which is inserted into slot 28 and coupled to the one or more microprocessor(s) 50. An SRAM memory 31 is also coupled to the microprocessor(s) 50 and contains the system program. The microprocessor is also coupled to one or more operator-actuated switches in the switch section 24 and to a display 26, such as a dot matrix display, for selectively displaying information, such as shown in Figs. 2 and 6-19, to the vehicle operator.

The point-of-interest circuit 20 is coupled to the vehicle power system, as shown in Fig. 3, and includes an ignition input for receiving power when the ignition is either in the run or accessory position, a B+ input drawing a maximum of 300 micro amps when the system is deactivated, a coupling to the system ground and a pulse width modulated dimming input circuit for dimming the back-lighted switches of the switch bank 24 and the dot matrix display 26 based upon the operator's selected lighting level for instrument displays. In some installations, the system could be coupled directly to the vehicle's power supply through the ignition switch and vehicle ground. In another, dimming information is received from the vehicle bus. The microprocessor 50 is also coupled to other vehicle systems, such as a vehicle compass 46 for displaying in the normal mode of operation, when the point-of-interest system is not being employed, the outside temperature, the compass heading, the time and date information, as seen in Fig. 11. The microprocessor may also be coupled to and employed for other vehicle control functions, such as a Homelink® brand programmable transmitter 48, and may be coupled to the vehicle bus 49 for receiving PWM dimming information, ignition run, accessory information, and the like. An outside temperature sensor and circuit 45 may be coupled to the microprocessor(s) 50 or the vehicle bus 49, as shown in Fig. 4, to provide the

temperature display as seen in Fig. 11. Also, a trip computer 47 may be coupled to the microprocessor(s) 50 or to the vehicle bus 49, as shown in Fig. 4, to provide typical trip functions, such as a resettable odometer, fuel consumption, average speed, and estimated time of arrival information, which can be displayed on display 26.

The user-friendly, intuitive switch controls 24 are seen in Fig. 2 and incorporate a menu switch 60, a scroll forward switch 61, a scroll back switch 62, which are physically positioned on the console pointing in a forward and rearward position, respectively, with arrows thereon so as to intuitively indicate to the vehicle operator that the actuation of the scroll switches advances the display to a point of interest or highway exit forward or behind the vehicle. The switch controls 24 also includes a select switch 63 for selecting a given entry highlighted by the movement of a display cursor 27 (Fig. 8) through actuation of scroll switches 61 and 62 and a back switch 64, which allows the operator to move back one entry. Additionally, keys 65, 66, and 67 are provided and are aligned with display icons showing "gas", "food", and "lodges", respectively, as seen in Fig. 2. When the system is employed with a HomeLink® brand trainable transmitter, the switches can, when the POI system is off (Fig. 6), provide the dual function of operating any one of the three programmed transmitting frequencies and codes for up to three different garage doors, home appliances, security gates, or the like.

The operation of the system seen in Figs. 1-4 is best understood by reference to the program flow diagram of Figs. 22A, 22B, and 22C together with the menu diagram with Fig. 5 in connection with the displayed information, as seen in Figs. 2 and 6-19. Initially, when this system is powered up, as shown in Fig. 20, the system searches for satellites and displays a message, as shown by Fig. 17. In the event a memory card or flashcard 29 has not been inserted, the system displays the message shown in Fig. 19, either that the "memory card is not inserted" or the message shown in Fig. 16, that "the vehicle is out of the current data coverage zone." Assuming the memory card is in place and the vehicle is in the data coverage zone and satellite signals have been received, the display screen of Fig. 6 is displayed allowing the operator the option of selecting points of interest (POI) by scrolling, utilizing switches 61 and 62, current information which provides any combination of the compass heading, time, date, and/or outside temperature information of Fig. 11 or trip computer information (not shown). The operator may also select the street sign selection showing either the address of a street on

which the vehicle is traveling, if on a secondary road, as shown by Fig. 9, or, if the scroll button is advanced and street signs has previously been selected, to the street sign display of Fig. 10.

Assuming the vehicle is on a limited access highway and the operator has selected "points of interest" by scrolling to move the cursor 27, shown in Fig. 6, to the "points of interest" selection, the operator enters select by actuating switch 63, and the highway point-of-interest mode, as shown in Figs. 2 and 7, is displayed on display 26. Such display provides information as to points of interest according to categories of gas, food, or lodging, which are displayed as shown by display icons 71, 73, and 75 in Figs. 2 and 7. Display 26 also displays the forthcoming exit which the vehicle is approaching, as indicated by display area 72 (Fig. 7), the name of the street associated with the exit, as indicated by display element 74, and the distance to the exit, as shown by display element 76. To the left of display icons 71, 73, and 75 is a numerical display 80 for indicating the number of gasoline stations available at that exit (*i.e.*, 4 for exit 102a), a numerical display 82 indicating the number of restaurants available at that exit (*i.e.*, 10), and a numerical display 84 indicating the number of lodges or sleeping accommodations available at that exit (*i.e.*, 3). By actuating scroll switches 61 or 62, the operator can scroll forward to display, for example, the information available at the next exit (No. 103, for example) or the previous exit (No. 101, for example) if at exit 102 a desired POI is not available. Thus, while in the highway POI mode, the vehicle operator can look ahead or behind for points of interest and, as discussed below, select and review available points of interest at a selected exit. This enables the operator to find, for example, a favorite restaurant while traveling when meal time is approaching.

As the vehicle travels along the highway, the operator can actuate any one of the three keys 65, 66, or 67 aligned above the display 81 of "gas", display 83 of "food", or display 85 of "lodges", respectively, to select details of the establishments in the available categories at a selected exit. Thus, if the gas key 65 is actuated, the display of Fig. 14 appears, and the "gas" icon 81 is illuminated. The display of Fig. 14 provides three service stations available at the selected exit and their distance. A similar display presentation for restaurants is shown in Fig. 13 and for lodging is shown in Fig. 12.

The operator then can scroll to the desired establishment, such as a Marathon station, as shown in Fig. 14, by actuation of switches 61 and 62 and select the

establishment aligned with the cursor 27 to be presented with a more detailed route to point-of-interest display, as shown in Fig. 15. In Fig. 15, the operator has scrolled up to the Marathon station and actuated the select switch 63. The detail display 87 shows the distance to the Marathon station (*i.e.*, 5.7 miles), and an arrow 88 shows the general direction of the station. The street address 89 of the service station, as well as its telephone number 89'. As the vehicle travels to the exit from which the POI was selected in the highway mode, this information is dynamically updated. Thus, arrow 88 changes direction and the distance information 87 of Fig. 15 is continuously updated. The distance displayed is the combined distance to the exit and from the exit to the Marathon station.

When the vehicle exits the highway, for example, at exit 102A, as shown in Fig. 7, the microprocessor detects from GPS signal and stored road network data programmed in the memory 31 that it is on a secondary road and automatically switches to one of the local point-of-interest displays shown in Figs. 8A or 8B, which, unless a POI has previously been selected as seen in Fig. 15, automatically displays the categories of points of interest available, the number of points of interest in each category through the icons 71, 73, and 75, and the nearest points of interest within a selectable range of, for example, two to four miles of the nearest points of interest regardless of the category. Again, the operator can select any one of the categories by actuating the switches 65, 66, and 67 after which the selected category will be displayed as shown in Figs. 12-14, and a go-to point of interest can be selected by movement of the cursor through actuation switches 61 and 62 and entry of a highlighted point of interest by select switch 63 to obtain the information for that point of interest, as represented, for example, by Fig. 15. If a POI had previously been selected, the display of Fig. 15 remains displayed to the operator.

If there are no points of interest found at a forthcoming exit, the display of Fig. 18 is displayed to the vehicle operator indicating that, at that exit, no selected category points of interest are available. The operator can either scroll forward to exits ahead of the vehicle or scroll backward using switches 61, 62 to a previous exit to look for a desired point of interest and determine which is the closest point of interest which satisfies the operator's needs. If on a local road and no POI are found within an initial

search range, the system will expand the search range until a POI is found and display either the Fig. 8A or Fig. 8B display to the operator.

In addition to the point-of-interest mode of operation, the operator can enter the street sign mode from the main menu by pushing the menu switch 60 and scrolling to street signs (Fig. 6). By actuating the select switch 63, the display of Fig. 9 is presented to the operator, which shows the direction 91 of travel of the vehicle, the road 92 on which the vehicle is traveling, and a street address display 93, which shows the street numbers and which increments or decrements as the vehicle travels along the street, to provide the operator with the ability to locate a point of interest which may have previously been identified by street number or is otherwise known to the operator. This display is particularly helpful where the point of interest is set back from the road, such as, for example, in a shopping mall or the like, and the address is not readily visible from the road. As is well known, the displayed address is interpolated from two known locations and the current vehicle position with respect to such locations as determined by the GPS information.

If the operator scrolls forward utilizing switch 61 while in the street sign mode displaying addresses, as shown in Fig. 9, the system enters the display of cross streets, as shown in Fig. 10, in which two streets ahead of the vehicle (*e.g.*, Second Avenue and Third Avenue in Fig. 10) are presented, as are arrows 94 indicating the location of the vehicle between Second Avenue and recently passed First Avenue. This provides the operator with an easily recognizable display of cross streets on a roadway defined by converging graphic lines 95, which includes arrows 94 to provide a clear graphic diagram to the vehicle operator as to the vehicle's location with respect to forthcoming cross streets. In the event that the area does not provide cross-street information or street addresses for a given location of the vehicle, a display is provided to the operator, indicating that such information is not available and the operator must return to the main menu and enter the highway or local point-of-interest mode for guidance. The operator can always select the current information display of Fig. 11 by actuating the back button 64 when in any of the other modes until the information is displayed or actuate the menu button and actuate cursor switches 61, 62 to align cursor 27 with current information and actuate the select switch 63 to provide the compass, temperature, time, and date information display of Fig. 11.

Fig. 5 illustrates the various operational modes described above by the actuation of the select, menu, back, scroll, and POI switches to select points of interest, select a category contained within the points of interest, identify a particular establishment in that category, and go to the point-of-interest display, which provides detailed information as to how to approach the selected point of interest. The flow diagram 100 of Figs. 22A, 22B, and 22C represents the programming of the microprocessor through the program contained in memory 31 of Fig. 4 to detect the actuation states of the various operator-actuated switches look at the data from the GPS receiver 40 and the flash memory 29 and display the resultant selected display information. The figure numbers of the display figures are included in the flow diagram 100.

Turning initially to Fig. 22A, the main menu 110 of Fig. 6 is displayed and the program looks at block 112 to determine if a highlighted entry has been selected and, if it has, whether the point of interest has been selected at block 114. If a point of interest display has been selected, the program moves to block 102 (Fig. 22B) and displays the point-of-interest menu of Fig. 7 or Fig. 8, depending on the location of the vehicle, either on a limited access highway or on a local roadway. If no entry has been selected in block 112, the program cycles through the main menu until such time as something has been selected by scrolling to and highlighting a desired entry. If no point of interest has been selected, the program detects at block 116 whether the street sign has been selected and, if not, at block 118, whether the current information has been selected. If current information has been selected, the display of Fig. 11 is presented, as shown by block 120. If street signs has been selected, the display of current address of Fig. 9 is presented as shown by block 122. If street signs is not selected and current information is, the program automatically updates from the data received from the compass, temperature sensor, and internal clock the information displayed in Fig. 11. The program then continues to detect at blocks 124 and 126 (Fig. 22B) whether or not menu or back has been selected. If not, it remains with the current display of Fig. 11.

If, at block 118, current information has not been selected, the program tests at block 128, whether the off selection has been entered and, if not, the program returns to the main menu 110. If off has been selected at block 128, the display is turned off, as indicated by block 134 (Fig. 22A), and the system is idle until such time as any switch

has been depressed, as indicated by block 136. When this occurs, the program returns to the main menu block 110 of Fig. 22A.

If a point of interest display has been actuated as indicated by an affirmative decision in block 114, the program moves to block 102 (Fig. 22B), displaying either the Fig. 7 or Fig. 8 menu, as indicated above. If a point of interest is not selected as indicated by a no decision in block 104, the program continues to look to see if menu or back has been selected at 130, 132 and, if not, cycles through the loop, including blocks 102 and 104, until such time as either a lodging point-of-interest key 67 (Fig. 2) has been actuated as indicated by block 105, a gas point-of-interest key 65 (Fig. 2) has been actuated, or a food point-of-interest key 66 has been selected as indicated by blocks 105-107, respectively, in Fig. 22B. If one of these categories has been selected as indicated by block 108, the point of interest distance, direction, and location of Fig. 15 is displayed. The program then detects whether a menu or back select switches have been actuated at blocks 140 and 142 and, if so, the program returns to either the main menu or displays the point-of-interest menu, as indicated in block 102.

If "street signs" is selected as indicated in block 116 (Fig. 22A) and the address of Fig. 9 is displayed, the program tests to determine if a menu select or back select switch has been actuated as indicated by blocks 144 and 146 (Fig. 22B). If the menu select switch has been actuated, the program returns to the main menu of block 110. If not and the back select switch has been actuated by an affirmative decision in block 142, the program also returns to the main menu. If the back select switch has not been actuated, the program tests to determine if the down arrow at block 148 has been actuated. If it has, the program displays the street sign mode of Fig. 10, as shown at block 150 and continues to display that until such time as either the menu select switch at block 152 has been actuated or the back select switch at block 154 has been actuated or the up arrow as indicated by block 156 has been actuated. If the down arrow select switch has not been actuated at block 148, the program returns to the current address display as shown at block 122. If the arrow up select switch has been actuated as indicated by an affirmative decision at block 156 or the back select switch activated, the program returns to the current address display of Fig. 9 indicated at block 122.

Thus, the flow diagram of the program of Figs. 22A-22C illustrates the operation performed by the program during a sequence of operation through the menu as shown

also in Fig. 5, as well as at the same time updating the location information from the GPS receiver and selected point-of-interest information, including distance to and/or direction to the selected point-of-interest information being displayed.

5 It will become apparent to those skilled in the art that various modifications to the preferred embodiment of the invention as described herein can be made without departing from the spirit or scope of the invention as defined by the appended claims.

The invention claimed is:

1. A point-of-interest display system for a vehicle comprising:
 - a current location detector for providing data representing the vehicle's current position;
 - a database of information including points of interest and road network information including highway exits and local roadway street names and addresses;
 - a microprocessor coupled to said detector and to said database for providing display output signals representing upcoming highway exit information as the vehicle proceeds along a highway to provide point-of-interest information related to an exit and to provide display output signals for displaying points of interest within a predetermined range from the current vehicle location;
 - a display coupled to said microprocessor for displaying a predetermined number of points of interests within said predetermined range of the vehicle; and
 - at least one operator-actuated switch coupled to said microprocessor to permit the operator to select a point of interest from a menu of available points of interest when on a highway or after exiting a highway to obtain detailed information regarding a selected point of interest.
2. The system as defined in claim 1 wherein said detector is a GPS receiver.
3. The system as defined in claim 1 wherein said predetermined range comprises a range of less than about four miles.
4. The system as defined in claim 3 wherein the number of points of interest displayed is at least two.
5. The system as defined in claim 1 wherein said point-of-interest information includes the categories of gas, food, and lodging and individual establishments within each category when available.

6. The system as defined in claim 5 wherein each establishment is identified by name.
7. The system as defined in claim 6 wherein each establishment is further identified by its address.
8. The system as defined in claim 7 wherein a phone number of a selected establishment is displayed.
9. The system as defined in claim 1 wherein said database has data sets layered thereon according to road network information and point-of-interest information such that said memory can be updated separately at different time intervals for separately updating the road network information and point-of-interest information.
10. The system as defined in claim 1 wherein said database includes points of interest and wherein said operator-actuated switches permit the operator to selectively display the exits on a highway on which the vehicle is traveling, wherein said microprocessor is programmed to respond to operator input signals from said switches to provide a scroll-forward display of upcoming highway exits and for displaying points of interest accessible at such highway exits
11. The system as defined in claim 1 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest when on a highway and said display displays the distance and direction to said selected point of interest.
12. The system as defined in claim 1 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest and said display selectively displays detailed information regarding a selected point of interest.

13. The system as defined in claim 1 wherein said microprocessor allows the operator to select for individual display one of said addresses on a street on which the vehicle is traveling and cross-streets ahead and behind the vehicle.

14. The system as defined in claim 1 and further including an electronic compass coupled to said display.

15. The system as defined in claim 1 and further including an outside temperature sensor coupled to said display.

16. The system as defined in claim 1 and further including a trip computer coupled to said display.

17. A point-of-interest display system for a vehicle comprising:

- a current location detector for providing data representing the vehicle's current position;

- a database of information including points of interest and road network information including highway exits and local roadway street names and addresses;

- a microprocessor coupled to said detector and to said database for providing display output signals representing upcoming highway exit information as the vehicle proceeds along a highway to automatically provide point-of-interest information related to an exit, and when the vehicle exits a highway provide display output signals for displaying points of interest within a predetermined range from the current vehicle location;

- a display coupled to said microprocessor for displaying a predetermined number of points of interests within said predetermined range of the vehicle; and

- at least one operator-actuated switch coupled to said microprocessor to permit the operator to select a point of interest from a menu of available points of interest when on a highway or after exiting a highway to obtain detailed information regarding a selected point of interest.

18. The system as defined in claim 17 wherein said detector is a GPS receiver.

19. The system as defined in claim 17 wherein said point-of-interest information includes the categories of gas, food, and lodging and individual establishments within each category when available.

20. The system as defined in claim 17 wherein said database has data sets layered thereon according to road network information and point-of-interest information such that said memory can be updated separately at different time intervals for separately updating the road network information and point-of-interest information.

21. The system as defined in claim 17 wherein said database includes points of interest and wherein said operator-actuated switches permit the operator to selectively display the exits on a highway on which the vehicle is traveling, wherein said microprocessor is programmed to respond to operator input signals from said switches to provide a scroll-forward display of upcoming highway exits and for displaying points of interest accessible at such highway exits

22. The system as defined in claim 17 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest when on a highway and said display displays the distance and direction to said selected point of interest.

23. The system as defined in claim 17 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest after exiting a highway said display selectively displays detailed information regarding a selected point of interest.

24. The system as defined in claim 17 wherein said microprocessor allows the operator to select for individual display one of said addresses on a street on which the vehicle is traveling and cross-streets ahead and behind the vehicle.

1/13

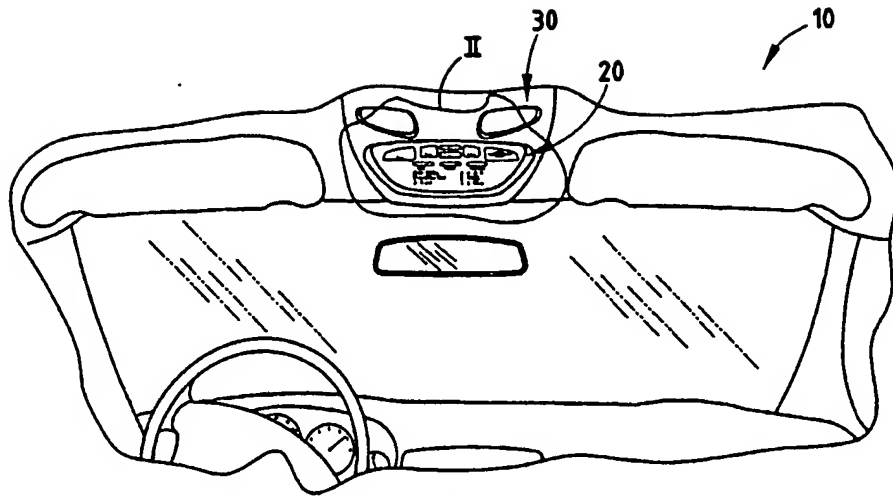


FIG. 1

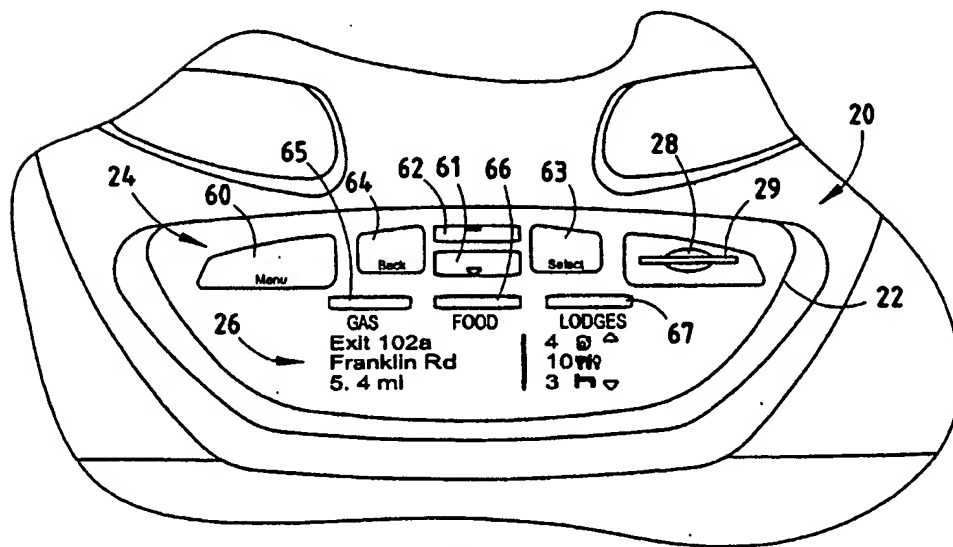


FIG. 2

2/13

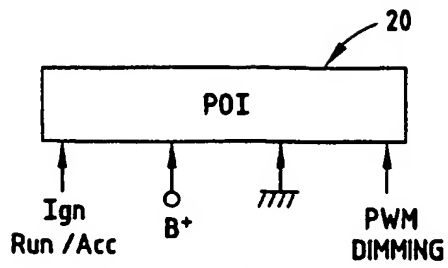


FIG. 3

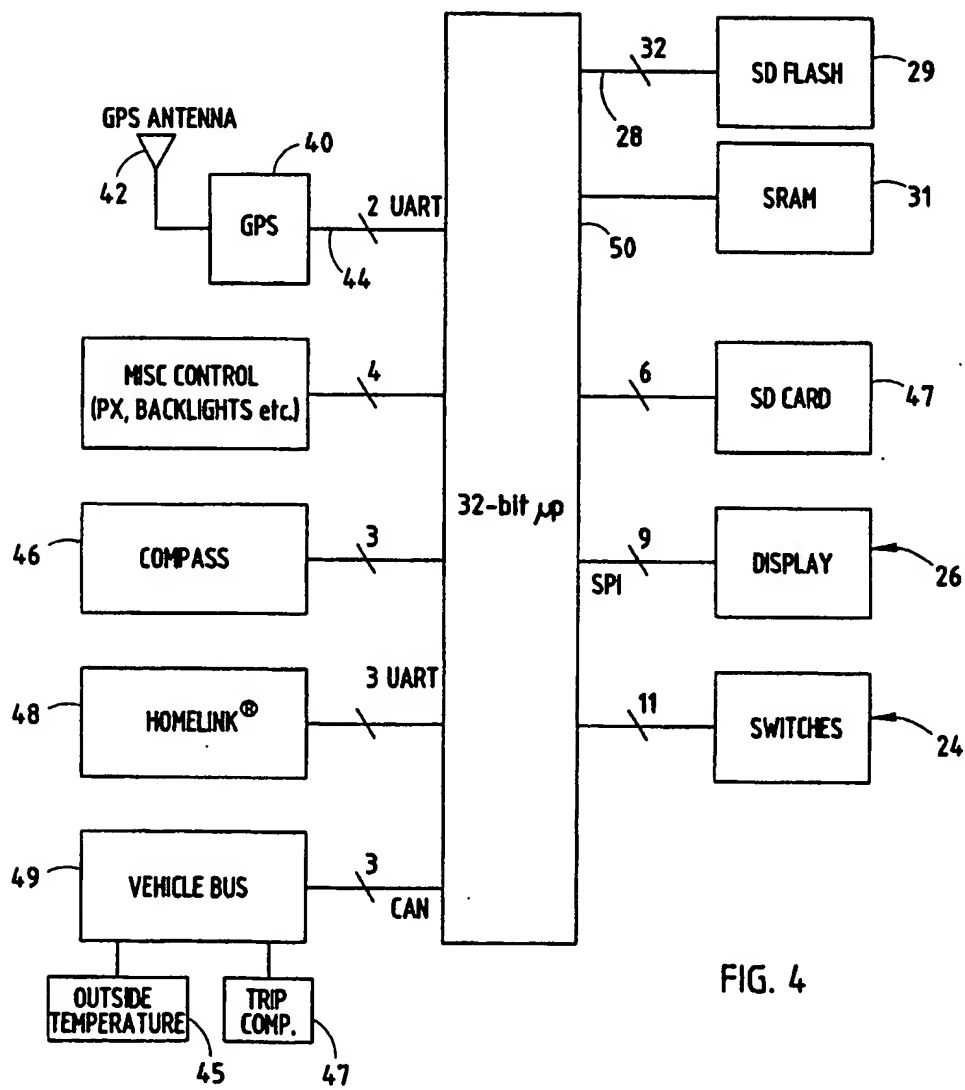


FIG. 4

3/13

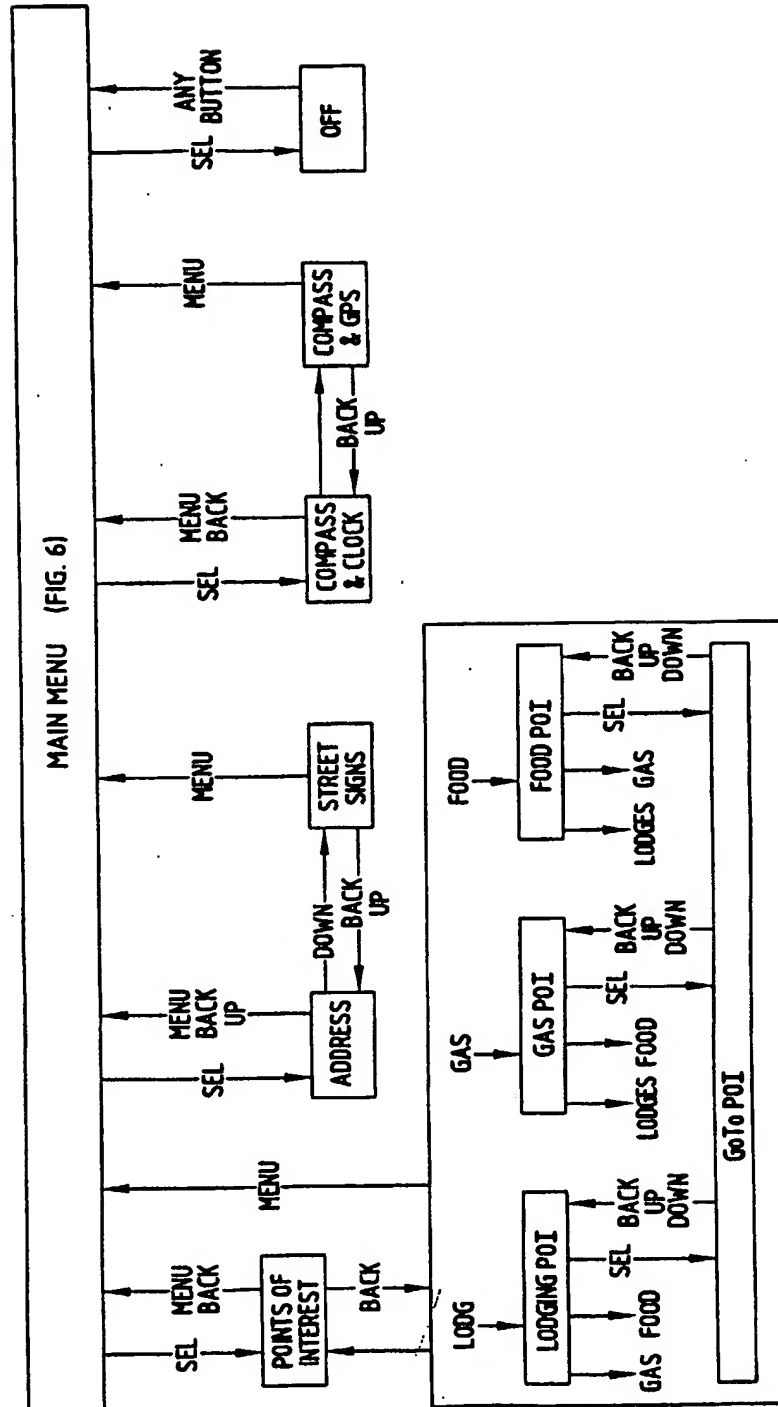


FIG. 5

4/13

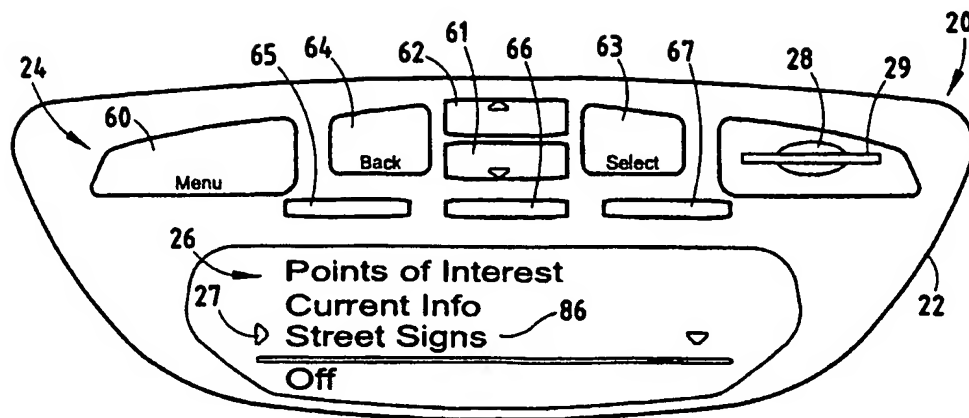


FIG. 6

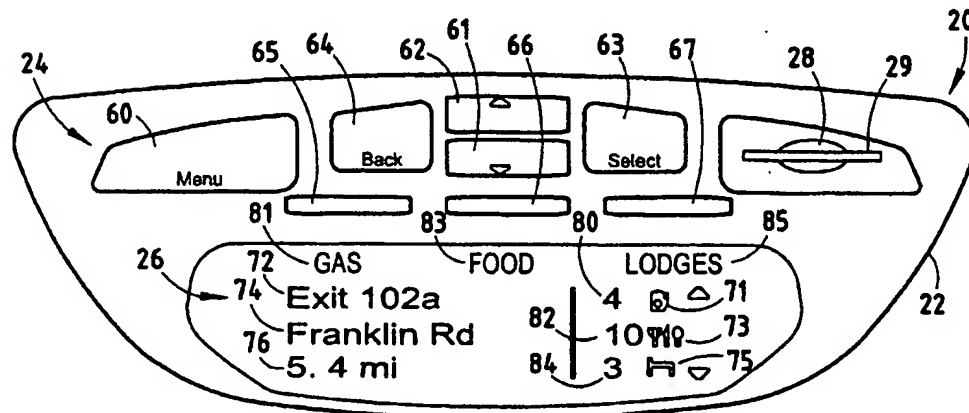


FIG. 7

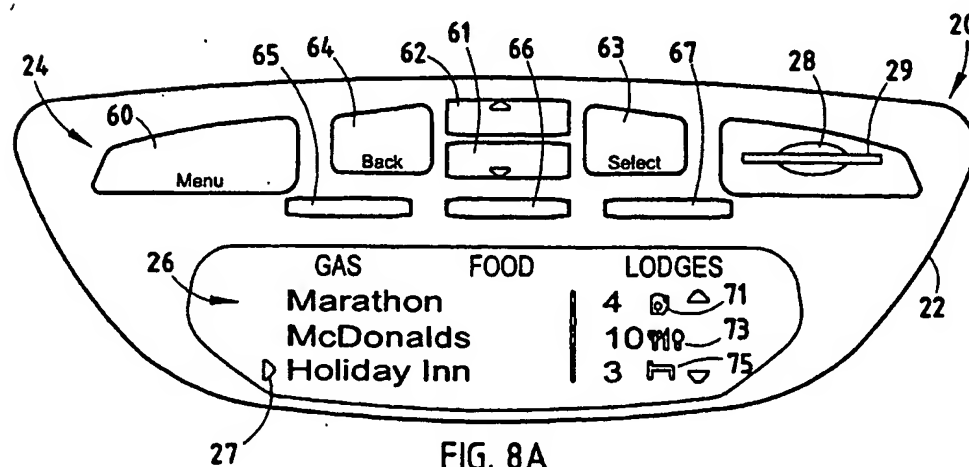


FIG. 8A

5/13

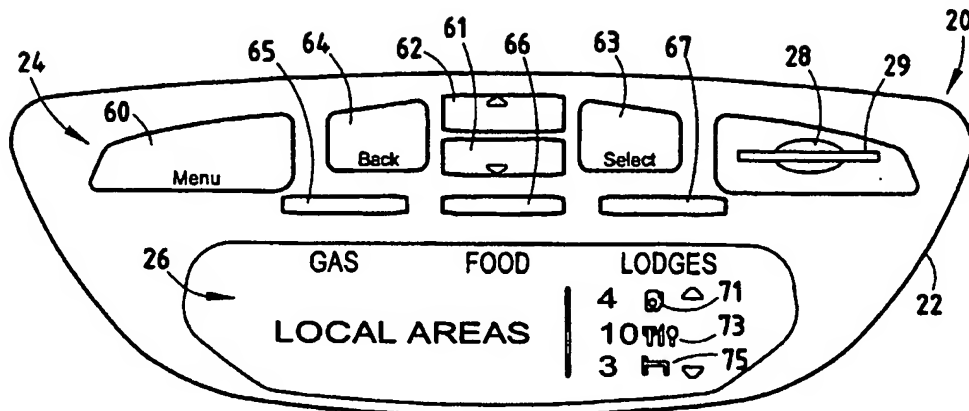


FIG. 8B

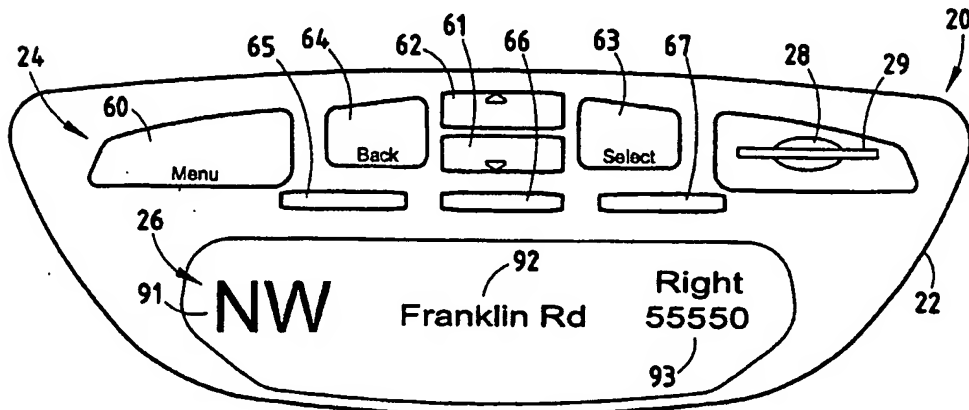


FIG. 9

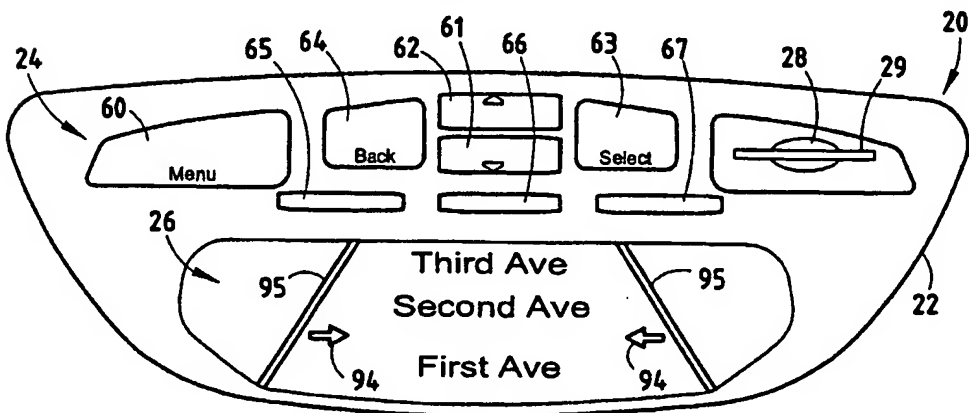


FIG. 10

6/13

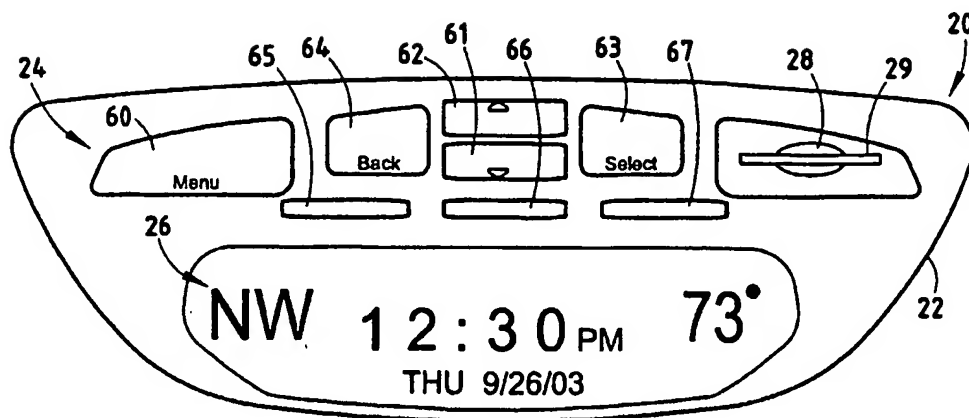


FIG. 11

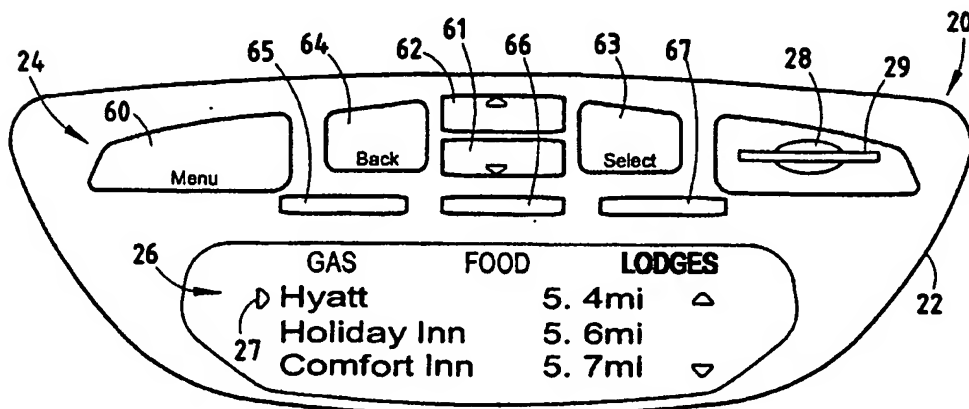


FIG. 12

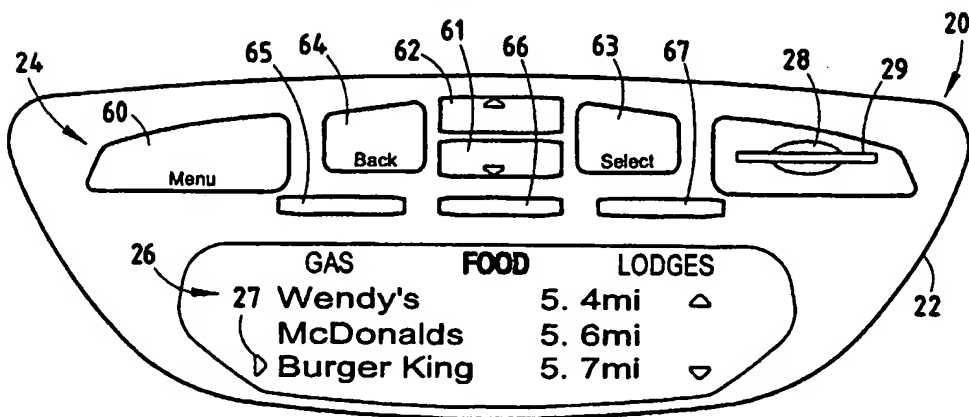


FIG. 13

7/13

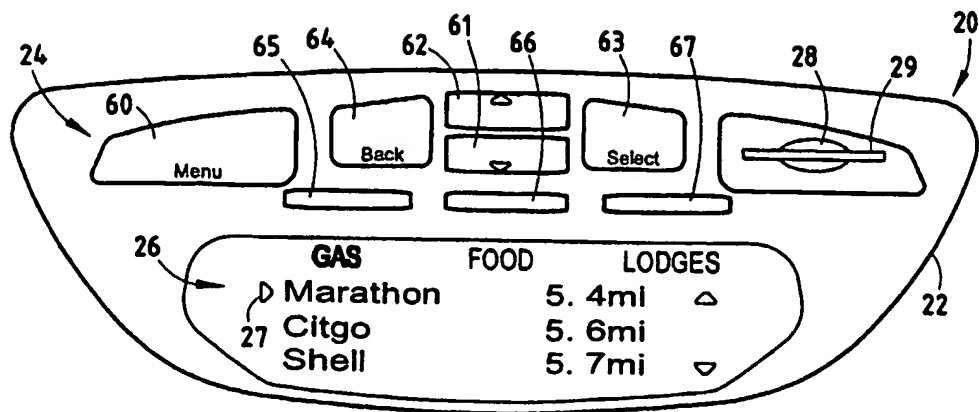


FIG. 14

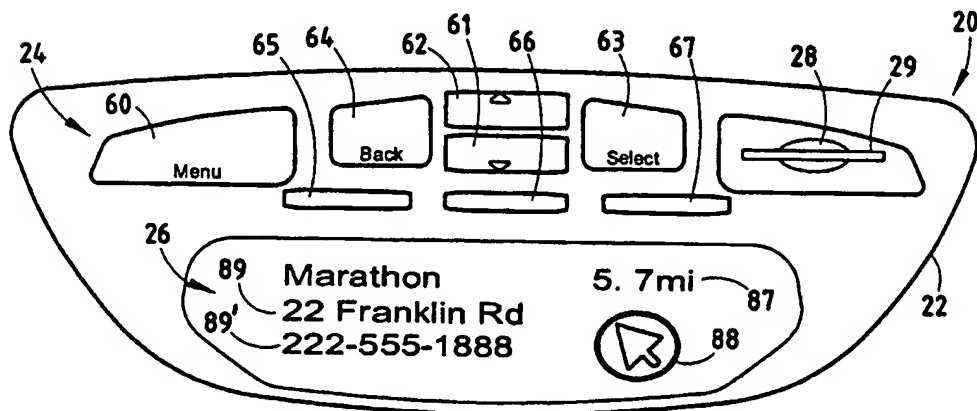


FIG. 15

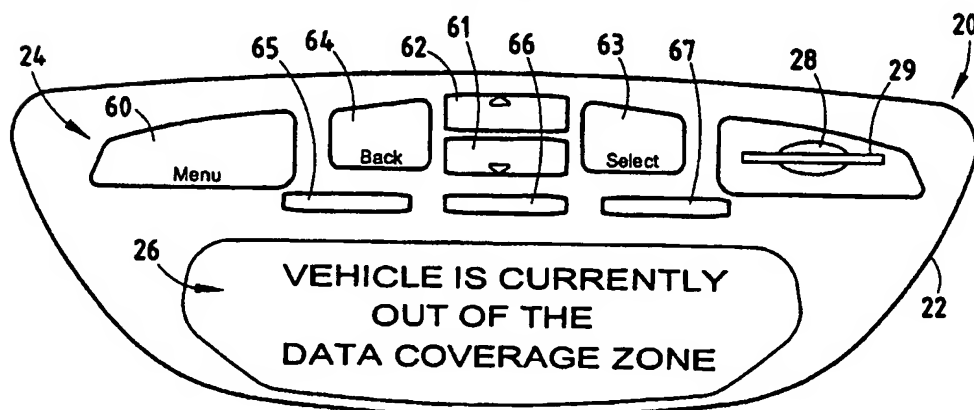


FIG. 16

8/13

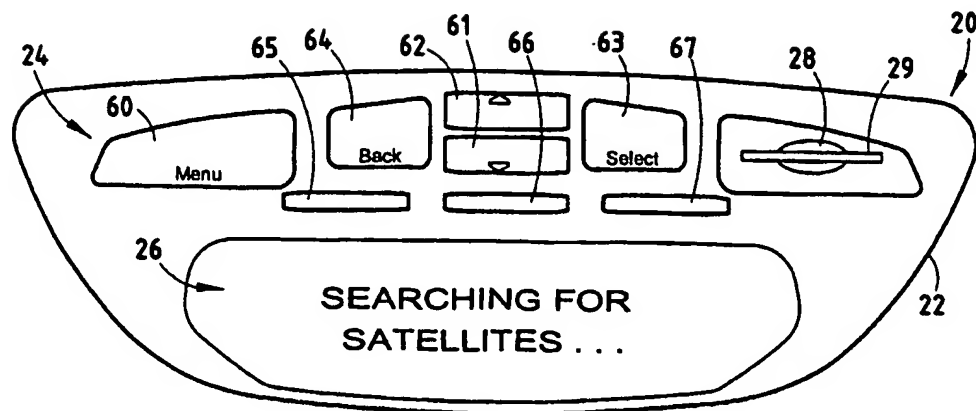


FIG. 17

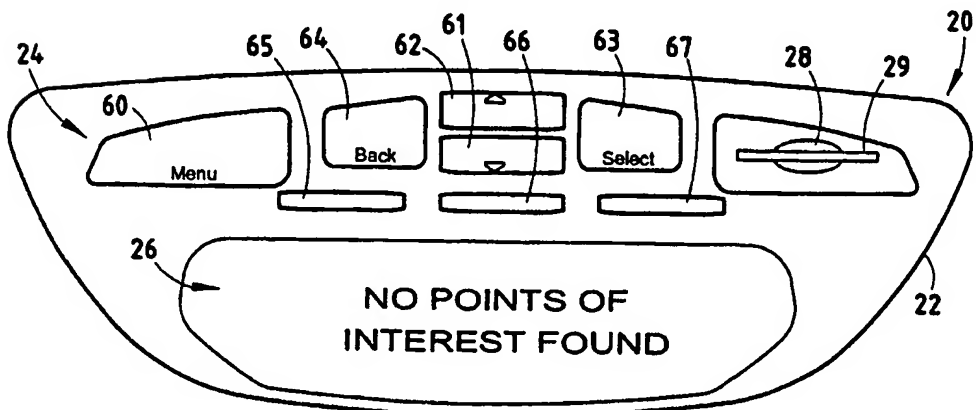


FIG. 18

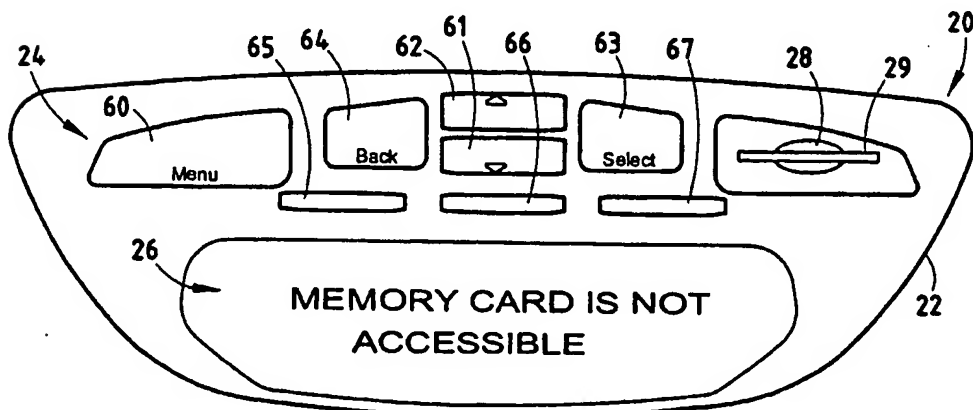


FIG. 19

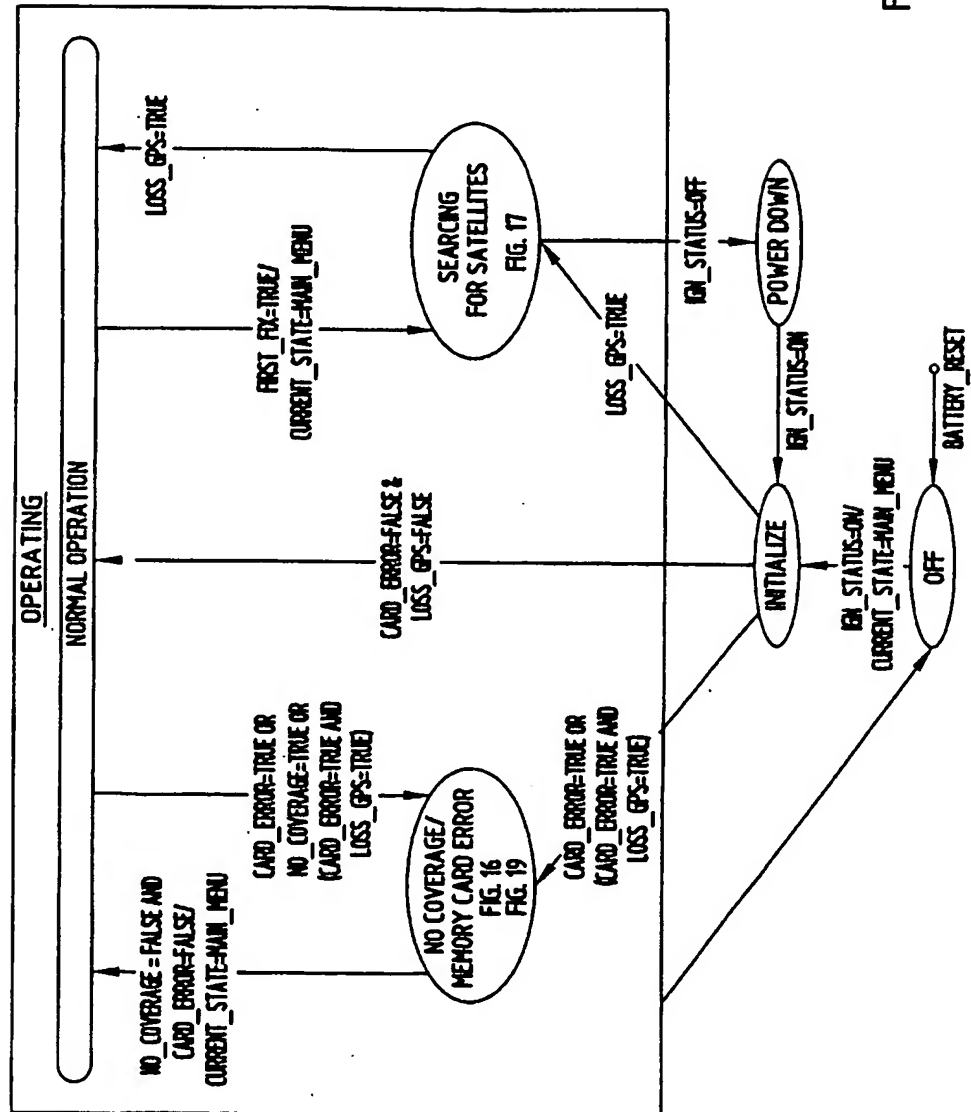


FIG. 20

10/13

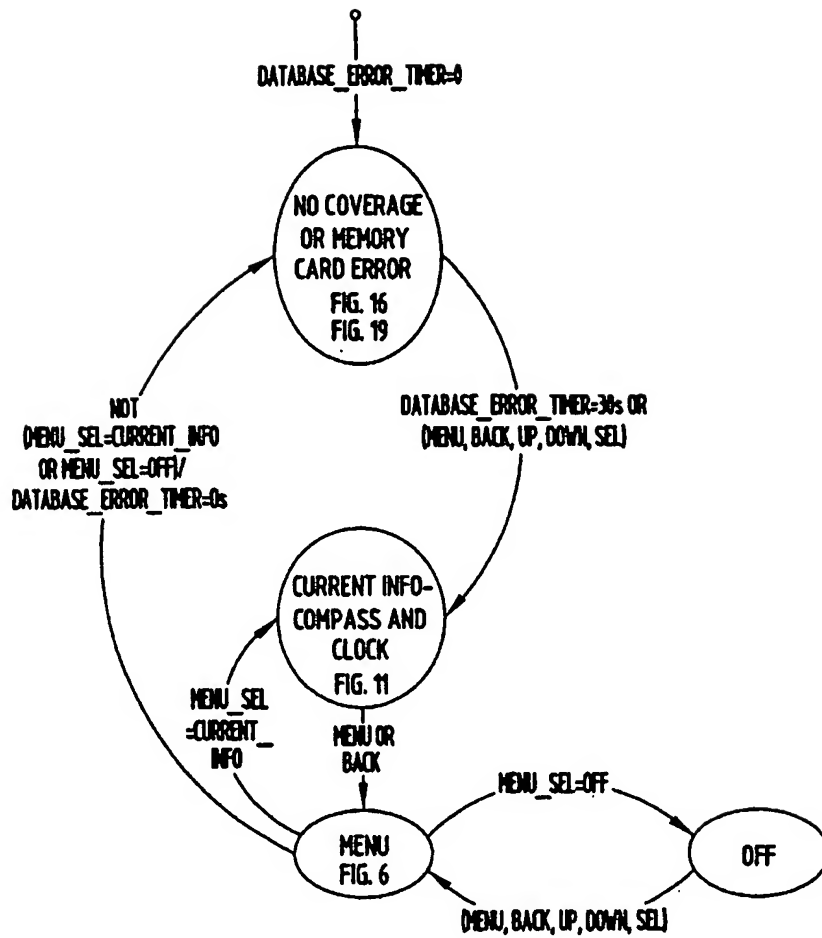


FIG. 21

11/13

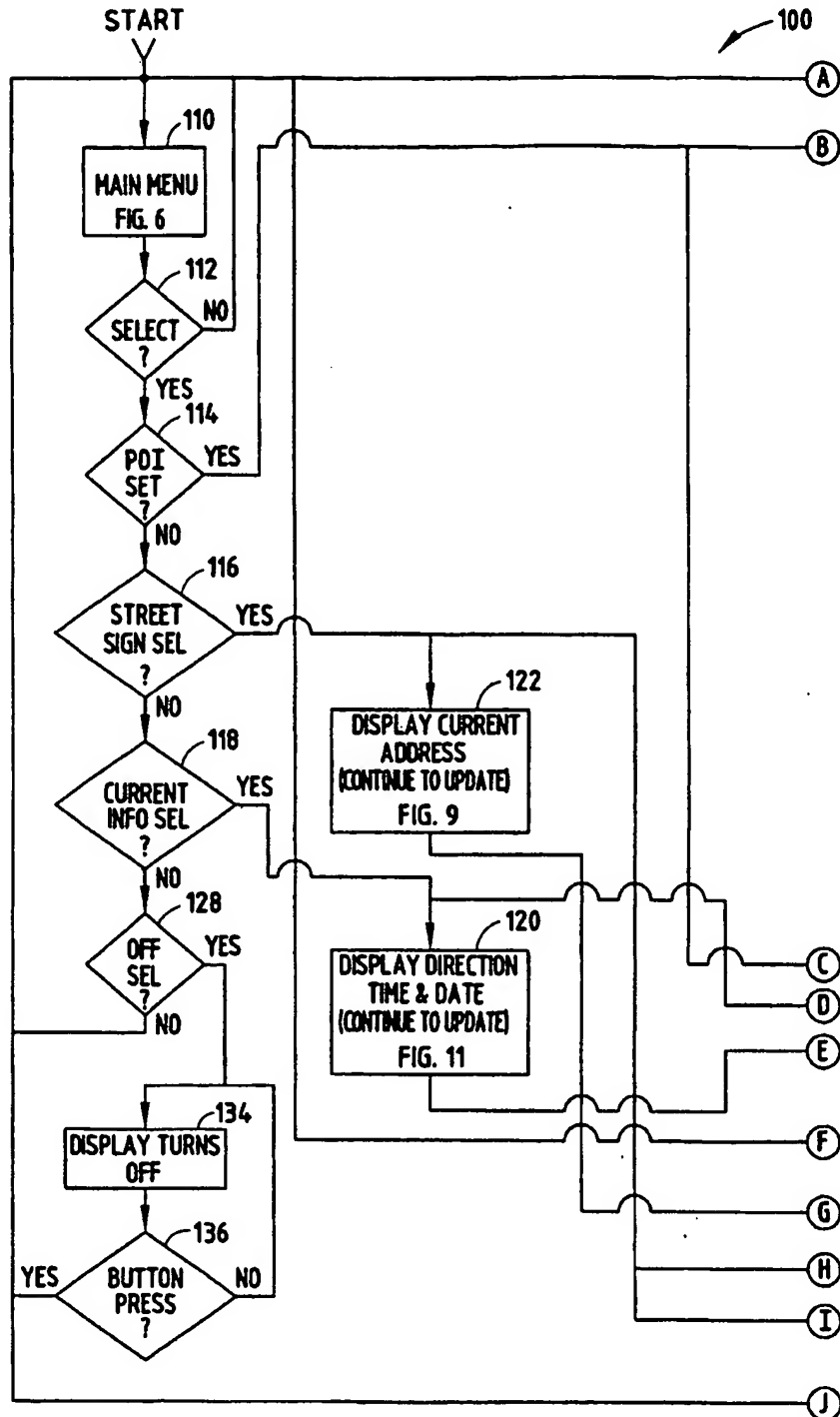


FIG. 22A

12/13

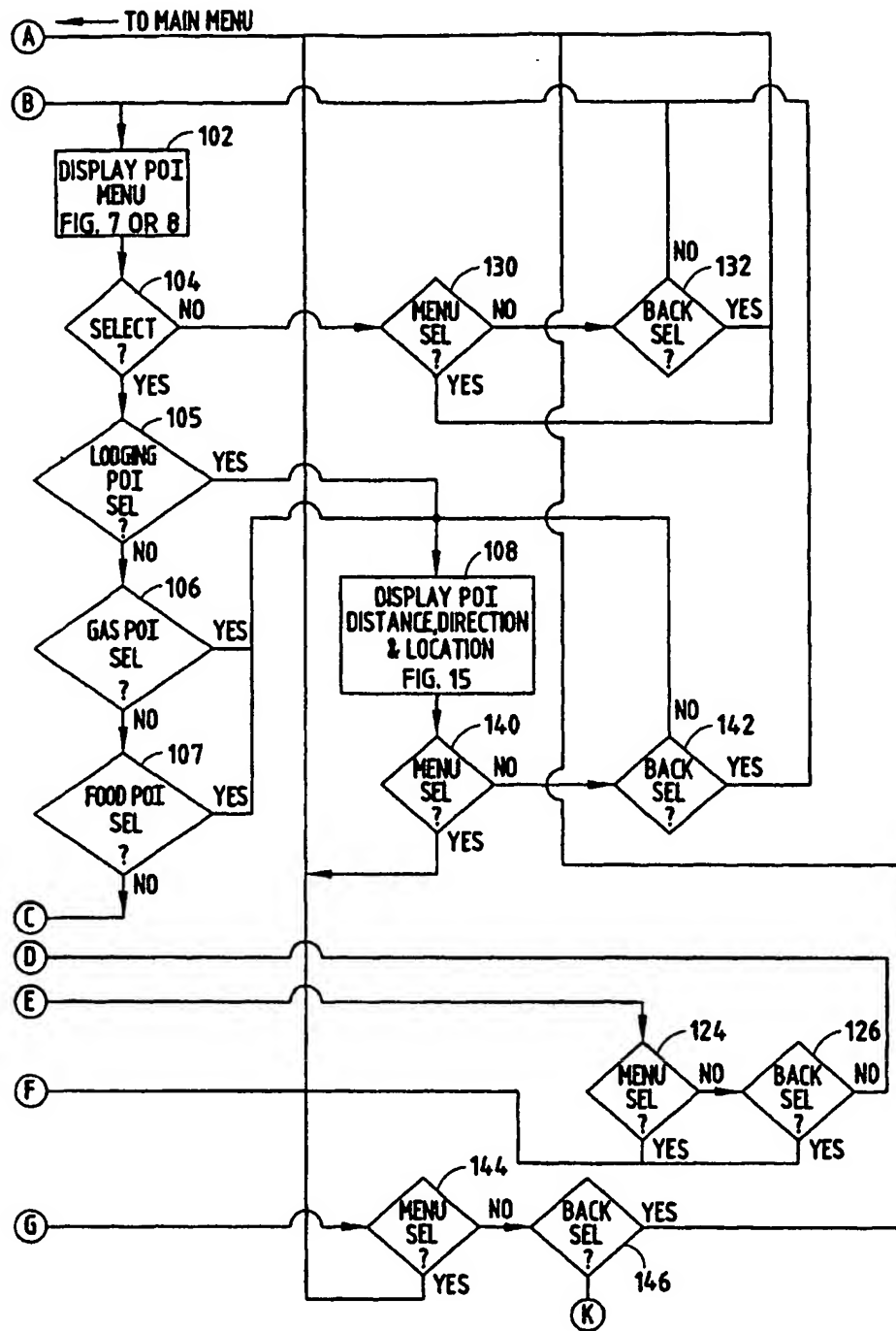


FIG. 22B

13/13

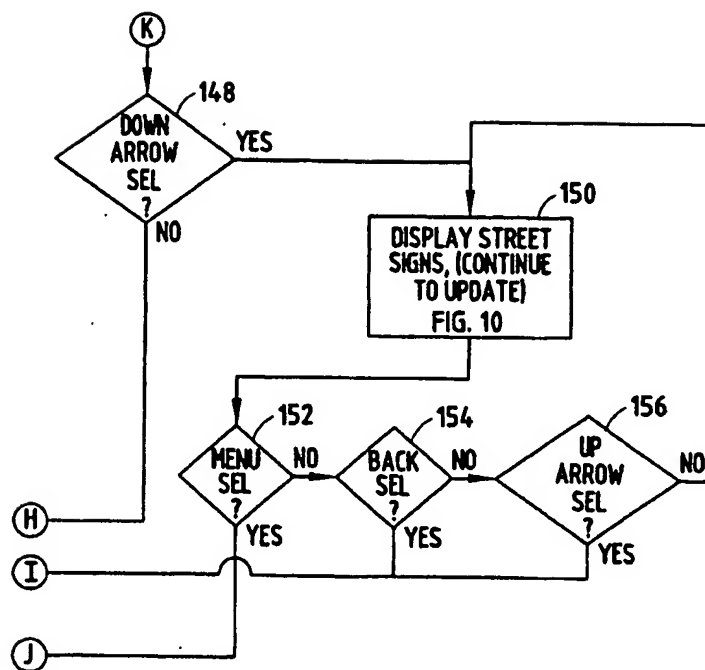


FIG. 22C

POINT-OF-INTEREST DISPLAY SYSTEM

BACKGROUND OF THE INVENTION

5 The present invention relates to a display system for a vehicle and particularly to one which provides a display of selected names of points of interest arranged by category and elemental directions to a selected point of interest. One embodiment provides a graphic display of cross-streets or addresses as the vehicle travels along a local roadway.

10 There exist numerous vehicle navigation systems which provide graphic map displays, which allow the vehicle operator, through significant manipulation of controls, to plan a travel route and obtain information about arrival destinations, typically by address. Some systems provide navigation control through the use of voice recognition programs and control circuits. All of these systems are relatively expensive, complicated and difficult for a vehicle operator to utilize, particularly when preoccupied with surrounding traffic in congested areas. Some suggested simplified navigation
15 systems allow the vehicle operator to either identify his or her current location by street address and forthcoming intersection information, as well as basic points of interest information. Such systems are relatively inexpensive but do not provide the operator with the flexibility of providing points-of-interest information in a user-friendly format nor additional desirable features, such as easily accessible alternate displays of forthcoming highway exits, street intersections, or street addresses when traveling on a
20 local street.

Thus, there remains a need for a display system for a vehicle which is relatively inexpensive and is user-friendly to operate using a minimum number of intuitive controls. Such a system needs to provide desirable features, such as points of interest in
25 selected categories which can be easily accessed with minimal operator intervention and yet provide the operator with sufficient information to be able to locate and travel to such points-of-interest.

SUMMARY OF THE INVENTION

30 The system of the present invention satisfies this need by providing a point-of-interest display system in which an updateable database includes road network information, which can be updated at relatively infrequent time intervals, and point-of-

interest information which can be user-updated at more frequent intervals, as new points of interest become available. In a preferred embodiment of the invention, the database is carried on the vehicle in the form of a flashcard or other removable memory device or loaded into flash memory residing in the vehicle via a data communication system. The database interfaces with a microprocessor on the vehicle which receives data from a current position detector, such as a GPS receiver, providing the system with current vehicle location and direction of travel information. A display provides the operator textural and elemental graphic display information, and one or more control switches are positioned in an easily accessible location within the vehicle such that the operator, by scrolling through displayed highway exits, can select categories of points of interest, and points of interest within a category upon the actuation of a minimal number of switches in an intuitive sequence.

In one embodiment of the invention, two modes of operation provide point-of-interest information either while the vehicle is traveling on a limited access highway or, once the vehicle has exited the highway, provides more specific point-of-interest directions. In another embodiment of the invention, the operator can, when on a local road, select the textural display of forthcoming and past intersecting streets, which is updated as the vehicle travels along the roadway. In yet another embodiment of the invention, the navigation system provides a display of the street addresses on which the vehicle is traveling and increments, decrements, or otherwise updates the address as the vehicle moves. In a preferred embodiment of the invention, each of these features are incorporated in a system which allows selection between the features, either manually or automatically as the vehicle moves between a limited access highway and a local roadway.

These and other features, objects and advantages of the present invention will become apparent upon reading the following description thereof together with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a fragmentary perspective view of a vehicle having a point-of-interest display system embodying the present invention;

Fig. 2 is an enlarged fragmentary view of the system shown in Fig. 1;

Fig. 3 is a block electrical diagram showing one interface connection of the system to the vehicle power system;

Fig. 4 is a block electrical circuit diagram of the point-of-interest system including its major components;

5 Fig. 5 is a flow diagram showing the menu operation for operation of the system shown in Figs. 1-4;

Fig. 6 is the display screen for the main menu;

Fig. 7 is the display screen illustrating the information displayed to the vehicle operator when in a highway point-of-interest mode of operation;

10 Figs. 8A and 8B are alternate display screens illustrating the information displayed to the vehicle operator when in a local point-of-interest mode of operation;

Fig. 9 is the display screen illustrating the information displayed to the vehicle operator when in a street-address mode of operation;

15 Fig. 10 is the display screen illustrating the information displayed to the vehicle operator when in a street-sign or cross-street mode of operation;

Fig. 11 is the display screen illustrating the information displayed to the vehicle operator when in a current-information mode of operation;

20 Fig. 12 is the display screen illustrating the information displayed to the vehicle operator when the lodging category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 13 is the display screen illustrating the information displayed to the vehicle operator when the food category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

25 Fig. 14 is the display screen illustrating the information displayed to the vehicle operator when the gas category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 15 is the display screen illustrating the information displayed to the vehicle operator when a particular point of interest in the highway mode has been selected;

30 Fig. 16 is the display screen illustrating the information displayed to the vehicle operator when the vehicle is out of the coverage zone;

Fig. 17 is the display screen illustrating the information displayed to the vehicle operator during initial start up when the GPS receiver is looking for satellites;

Fig. 18 is the display screen illustrating the information displayed to the vehicle operator when no point of interest was found at a selected exit;

Fig. 19 is the display screen illustrating the information displayed to the vehicle operator in the event a memory card has not been inserted into the circuit;

5 Fig. 20 is a flow diagram of the operation of the system during start up and shut down;

Fig. 21 is a flow diagram of the normal operation mode of the system; and

Figs. 22A, 22B, and 22C are a detailed flow diagram of the programming of the system during operation.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring initially to Fig. 1, there is shown a vehicle 10, such as an automobile, van, sports utility vehicle, truck, or the like, which incorporates a point-of-interest display system of one embodiment of the present invention. The point-of-interest display system 20 is mounted in one embodiment in an overhead console 30, although it can be mounted at any conveniently accessible location within easy reach of the vehicle operator, such as in the instrument panel. The point-of-interest system includes a switch group 24 and a display section 26, shown in detail in Fig. 2. The point-of-interest system can be mounted within a housing 22, which includes both the display 26 and switch section 24, as well as a memory card slot 28 for receiving a removable memory card 29, such as a flashcard on which the point-of-interest and road network data is programmed. Alternatively, separate mounting of the components is possible.

20 The memory card 29 typically will be at least a 128 meg card, although 256 or 512 meg cards may be preferred. The memory card is removable from slot 28, such that data thereon, including road network information and point-of-interest (POI) information, can be separately programmed in layers thereon, such that the road network and POI data can be refreshed at different, periodic intervals. Memory card 29 includes nonvolatile memory and contains a handshake code to communicate with a microprocessor 50 (Fig. 4) of the system, so the microprocessor can read data on the memory card 29. The system, as seen in Fig. 4, also includes a programmable SRAM memory 31, which contains the program for the sequential operation of the system, as shown in Fig. 5. The flow diagram for the program is shown in Figs. 22A, 22B, and 22C, described below. In one embodiment memory card 29 can be obtained from a car

dealer with an update subscription service for refreshing the data on the card either annually, in the case of road network information, or more frequently as new points of interest may become available, such as, for example, on a monthly basis. Alternatively, the user may subscribe to a web site providing download information for refreshing the data on memory card 29 on a personal computer if desired. Card 29 may also be updated through other means. Typically, the memory card will have data sufficient for a regional area in which the vehicle normally travels and will contain points of interest according to categories, such as gas, food, and lodging, as well as all the major (*i.e.*, limited access) and secondary road identifications and street addresses for secondary roads.

The map database is composed of at least two layers, at least one of which includes data like points of interest that change frequently. It is, therefore, desirable to update this information frequently. Another layer or layers of data contain information like the road network that may be undated less frequently. The data layers are linked and each layer may be updated either independently or in combination with other layers. This allows the consumer to obtain updated information without excessive download time when refreshing the data through the Internet, since the update can be limited to the part of the data that changes frequently.

Each layer is contained within a single file on the flashcard 29 for a given geographical area. Every POI record, whether for highway or local coverage, references a street name record in the road network file. This reference is stored in the POI file as an index into the street name table in the road network file.

As the latest POI information is released and compiled, every POI file that is created is associated with the latest road network file available. In addition, any new points of interest that are associated with roads that are not yet compiled into the latest road network file are added to the POI file but are flagged as being without a street name. All other POI attributes, such as telephone number, latitude/longitude and name, are still available in this case. Details of some aspects of the programming of they system to provide the various modes of operation are disclosed in Application No. 60/419,934, entitled **SYSTEM AND METHOD FOR DISPLAYING VEHICLE LOCATION AND POINT OF INTEREST INFORMATION**, the disclosure of which is incorporated herein by reference and in connection with the flow diagrams of Figs. 22A-22C.

The system, as best seen in Fig. 4, includes a current location detection device, such as GPS receiver 40, having an antenna 42 for receiving global positioning satellite signals from multiple satellites and providing current location data to one or more microprocessor(s) 50, which can be a Motorola MC9512DJ64 or its equivalent, through a universal asynchronous receiver/transmitter connection 44. Other current location detection sources of data, such as a Loran receiver, gyro compass, or dead reckoning information sources, may also be employed but a GPS receiver represents the current best mode of receiving such data. The microprocessor receives vehicle location data from the GPS receiver and point-of-interest and road network data from the flashcard 29, which is inserted into slot 28 and coupled to the one or more microprocessor(s) 50. An SRAM memory 31 is also coupled to the microprocessor(s) 50 and contains the system program. The microprocessor is also coupled to one or more operator-actuated switches in the switch section 24 and to a display 26, such as a dot matrix display, for selectively displaying information, such as shown in Figs. 2 and 6-19, to the vehicle operator.

The point-of-interest circuit 20 is coupled to the vehicle power system, as shown in Fig. 3, and includes an ignition input for receiving power when the ignition is either in the run or accessory position, a B+ input drawing a maximum of 300 micro amps when the system is deactivated, a coupling to the system ground and a pulse width modulated dimming input circuit for dimming the back-lighted switches of the switch bank 24 and the dot matrix display 26 based upon the operator's selected lighting level for instrument displays. In some installations, the system could be coupled directly to the vehicle's power supply through the ignition switch and vehicle ground. In another, dimming information is received from the vehicle bus. The microprocessor 50 is also coupled to other vehicle systems, such as a vehicle compass 46 for displaying in the normal mode of operation, when the point-of-interest system is not being employed, the outside temperature, the compass heading, the time and date information, as seen in Fig. 11. The microprocessor may also be coupled to and employed for other vehicle control functions, such as a Homelink® brand programmable transmitter 48, and may be coupled to the vehicle bus 49 for receiving PWM dimming information, ignition run, accessory information, and the like. An outside temperature sensor and circuit 45 may be coupled to the microprocessor(s) 50 or the vehicle bus 49, as shown in Fig. 4, to provide the

temperature display as seen in Fig. 11. Also, a trip computer 47 may be coupled to the microprocessor(s) 50 or to the vehicle bus 49, as shown in Fig. 4, to provide typical trip functions, such as a resettable odometer, fuel consumption, average speed, and estimated time of arrival information, which can be displayed on display 26.

5 The user-friendly, intuitive switch controls 24 are seen in Fig. 2 and incorporate a menu switch 60, a scroll forward switch 61, a scroll back switch 62, which are physically positioned on the console pointing in a forward and rearward position, respectively, with arrows thereon so as to intuitively indicate to the vehicle operator that the actuation of the scroll switches advances the display to a point of interest or highway exit forward or behind the vehicle. The switch controls 24 also includes a select switch
10 63 for selecting a given entry highlighted by the movement of a display cursor 27 (Fig. 8) through actuation of scroll switches 61 and 62 and a back switch 64, which allows the operator to move back one entry. Additionally, keys 65, 66, and 67 are provided and are aligned with display icons showing "gas", "food", and "lodges", respectively, as
15 seen in Fig. 2. When the system is employed with a HomeLink® brand trainable transmitter, the switches can, when the POI system is off (Fig. 6), provide the dual function of operating any one of the three programmed transmitting frequencies and codes for up to three different garage doors, home appliances, security gates, or the like.

 The operation of the system seen in Figs. 1-4 is best understood by reference to
20 the program flow diagram of Figs. 22A, 22B, and 22C together with the menu diagram with Fig. 5 in connection with the displayed information, as seen in Figs. 2 and 6-19. Initially, when this system is powered up, as shown in Fig. 20, the system searches for satellites and displays a message, as shown by Fig. 17. In the event a memory card or flashcard 29 has not been inserted, the system displays the message shown in Fig. 19,
25 either that the "memory card is not inserted" or the message shown in Fig. 16, that "the vehicle is out of the current data coverage zone." Assuming the memory card is in place and the vehicle is in the data coverage zone and satellite signals have been received, the display screen of Fig. 6 is displayed allowing the operator the option of selecting points of interest (POI) by scrolling, utilizing switches 61 and 62, current information which
30 provides any combination of the compass heading, time, date, and/or outside temperature information of Fig. 11 or trip computer information (not shown). The operator may also select the street sign selection showing either the address of a street on

which the vehicle is traveling, if on a secondary road, as shown by Fig. 9, or, if the scroll button is advanced and street signs has previously been selected, to the street sign display of Fig. 10.

5 Assuming the vehicle is on a limited access highway and the operator has selected "points of interest" by scrolling to move the cursor 27, shown in Fig. 6, to the "points of interest" selection, the operator enters select by actuating switch 63, and the highway point-of-interest mode, as shown in Figs. 2 and 7, is displayed on display 26. Such display provides information as to points of interest according to categories of gas, food, or lodging, which are displayed as shown by display icons 71, 73, and 75 in Figs. 10 2 and 7. Display 26 also displays the forthcoming exit which the vehicle is approaching, as indicated by display area 72 (Fig. 7), the name of the street associated with the exit, as indicated by display element 74, and the distance to the exit, as shown by display element 76. To the left of display icons 71, 73, and 75 is a numerical display 80 for indicating the number of gasoline stations available at that exit (*i.e.*, 4 for exit 102a), a 15 numerical display 82 indicating the number of restaurants available at that exit (*i.e.*, 10), and a numerical display 84 indicating the number of lodges or sleeping accommodations available at that exit (*i.e.*, 3). By actuating scroll switches 61 or 62, the operator can scroll forward to display, for example, the information available at the next exit (No. 103, for example) or the previous exit (No. 101, for example) if at exit 102 a desired 20 POI is not available. Thus, while in the highway POI mode, the vehicle operator can look ahead or behind for points of interest and, as discussed below, select and review available points of interest at a selected exit. This enables the operator to find, for example, a favorite restaurant while traveling when meal time is approaching.

25 As the vehicle travels along the highway, the operator can actuate any one of the three keys 65, 66, or 67 aligned above the display 81 of "gas", display 83 of "food", or display 85 of "lodges", respectively, to select details of the establishments in the available categories at a selected exit. Thus, if the gas key 65 is actuated, the display of Fig. 14 appears, and the "gas" icon 81 is illuminated. The display of Fig. 14 provides three service stations available at the selected exit and their distance. A similar display 30 presentation for restaurants is shown in Fig. 13 and for lodging is shown in Fig. 12.

The operator then can scroll to the desired establishment, such as a Marathon station, as shown in Fig. 14, by actuation of switches 61 and 62 and select the

establishment aligned with the cursor 27 to be presented with a more detailed route to point-of-interest display, as shown in Fig. 15. In Fig. 15, the operator has scrolled up to the Marathon station and actuated the select switch 63. The detail display 87 shows the distance to the Marathon station (*i.e.*, 5.7 miles), and an arrow 88 shows the general direction of the station. The street address 89 of the service station, as well as its telephone number 89'. As the vehicle travels to the exit from which the POI was selected in the highway mode, this information is dynamically updated. Thus, arrow 88 changes direction and the distance information 87 of Fig. 15 is continuously updated. The distance displayed is the combined distance to the exit and from the exit to the Marathon station.

When the vehicle exits the highway, for example, at exit 102A, as shown in Fig. 7, the microprocessor detects from GPS signal and stored road network data programmed in the memory 31 that it is on a secondary road and automatically switches to one of the local point-of-interest displays shown in Figs. 8A or 8B, which, unless a POI has previously been selected as seen in Fig. 15, automatically displays the categories of points of interest available, the number of points of interest in each category through the icons 71, 73, and 75, and the nearest points of interest within a selectable range of, for example, two to four miles of the nearest points of interest regardless of the category. Again, the operator can select any one of the categories by actuating the switches 65, 66, and 67 after which the selected category will be displayed as shown in Figs. 12-14, and a go-to point of interest can be selected by movement of the cursor through actuation switches 61 and 62 and entry of a highlighted point of interest by select switch 63 to obtain the information for that point of interest, as represented, for example, by Fig. 15. If a POI had previously been selected, the display of Fig. 15 remains displayed to the operator.

If there are no points of interest found at a forthcoming exit, the display of Fig. 18 is displayed to the vehicle operator indicating that, at that exit, no selected category points of interest are available. The operator can either scroll forward to exits ahead of the vehicle or scroll backward using switches 61, 62 to a previous exit to look for a desired point of interest and determine which is the closest point of interest which satisfies the operator's needs. If on a local road and no POI are found within an initial

search range, the system will expand the search range until a POI is found and display either the Fig. 8A or Fig. 8B display to the operator.

In addition to the point-of-interest mode of operation, the operator can enter the street sign mode from the main menu by pushing the menu switch 60 and scrolling to street signs (Fig. 6). By actuating the select switch 63, the display of Fig. 9 is presented to the operator, which shows the direction 91 of travel of the vehicle, the road 92 on which the vehicle is traveling, and a street address display 93, which shows the street numbers and which increments or decrements as the vehicle travels along the street, to provide the operator with the ability to locate a point of interest which may have previously been identified by street number or is otherwise known to the operator. This display is particularly helpful where the point of interest is set back from the road, such as, for example, in a shopping mall or the like, and the address is not readily visible from the road. As is well known, the displayed address is interpolated from two known locations and the current vehicle position with respect to such locations as determined by the GPS information.

If the operator scrolls forward utilizing switch 61 while in the street sign mode displaying addresses, as shown in Fig. 9, the system enters the display of cross streets, as shown in Fig. 10, in which two streets ahead of the vehicle (*e.g.*, Second Avenue and Third Avenue in Fig. 10) are presented, as are arrows 94 indicating the location of the vehicle between Second Avenue and recently passed First Avenue. This provides the operator with an easily recognizable display of cross streets on a roadway defined by converging graphic lines 95, which includes arrows 94 to provide a clear graphic diagram to the vehicle operator as to the vehicle's location with respect to forthcoming cross streets. In the event that the area does not provide cross-street information or street addresses for a given location of the vehicle, a display is provided to the operator, indicating that such information is not available and the operator must return to the main menu and enter the highway or local point-of-interest mode for guidance. The operator can always select the current information display of Fig. 11 by actuating the back button 64 when in any of the other modes until the information is displayed or actuate the menu button and actuate cursor switches 61, 62 to align cursor 27 with current information and actuate the select switch 63 to provide the compass, temperature, time, and date information display of Fig. 11.

Fig. 5 illustrates the various operational modes described above by the actuation of the select, menu, back, scroll, and POI switches to select points of interest, select a category contained within the points of interest, identify a particular establishment in that category, and go to the point-of-interest display, which provides detailed information as to how to approach the selected point of interest. The flow diagram 100 of Figs. 22A, 22B, and 22C represents the programming of the microprocessor through the program contained in memory 31 of Fig. 4 to detect the actuation states of the various operator-actuated switches look at the data from the GPS receiver 40 and the flash memory 29 and display the resultant selected display information. The figure numbers of the display figures are included in the flow diagram 100.

Turning initially to Fig. 22A, the main menu 110 of Fig. 6 is displayed and the program looks at block 112 to determine if a highlighted entry has been selected and, if it has, whether the point of interest has been selected at block 114. If a point of interest display has been selected, the program moves to block 102 (Fig. 22B) and displays the point-of-interest menu of Fig. 7 or Fig. 8, depending on the location of the vehicle, either on a limited access highway or on a local roadway. If no entry has been selected in block 112, the program cycles through the main menu until such time as something has been selected by scrolling to and highlighting a desired entry. If no point of interest has been selected, the program detects at block 116 whether the street sign has been selected and, if not, at block 118, whether the current information has been selected. If current information has been selected, the display of Fig. 11 is presented, as shown by block 120. If street signs has been selected, the display of current address of Fig. 9 is presented as shown by block 122. If street signs is not selected and current information is, the program automatically updates from the data received from the compass, temperature sensor, and internal clock the information displayed in Fig. 11. The program then continues to detect at blocks 124 and 126 (Fig. 22B) whether or not menu or back has been selected. If not, it remains with the current display of Fig. 11.

If, at block 118, current information has not been selected, the program tests at block 128, whether the off selection has been entered and, if not, the program returns to the main menu 110. If off has been selected at block 128, the display is turned off, as indicated by block 134 (Fig. 22A), and the system is idle until such time as any switch

has been depressed, as indicated by block 136. When this occurs, the program returns to the main menu block 110 of Fig. 22A.

5 If a point of interest display has been actuated as indicated by an affirmative decision in block 114, the program moves to block 102 (Fig. 22B), displaying either the Fig. 7 or Fig. 8 menu, as indicated above. If a point of interest is not selected as indicated by a no decision in block 104, the program continues to look to see if menu or back has been selected at 130, 132 and, if not, cycles through the loop, including blocks 102 and 104, until such time as either a lodging point-of-interest key 67 (Fig. 2) has been actuated as indicated by block 105, a gas point-of-interest key 65 (Fig. 2) has been
10 actuated, or a food point-of-interest key 66 has been selected as indicated by blocks 105-107, respectively, in Fig. 22B. If one of these categories has been selected as indicated by block 108, the point of interest distance, direction, and location of Fig. 15 is displayed. The program then detects whether a menu or back select switches have been actuated at blocks 140 and 142 and, if so, the program returns to either the main menu
15 or displays the point-of-interest menu, as indicated in block 102.

If "street signs" is selected as indicated in block 116 (Fig. 22A) and the address of Fig. 9 is displayed, the program tests to determine if a menu select or back select switch has been actuated as indicated by blocks 144 and 146 (Fig. 22B). If the menu select switch has been actuated, the program returns to the main menu of block 110. If
20 not and the back select switch has been actuated by an affirmative decision in block 142, the program also returns to the main menu. If the back select switch has not been actuated, the program tests to determine if the down arrow at block 148 has been actuated. If it has, the program displays the street sign mode of Fig. 10, as shown at block 150 and continues to display that until such time as either the menu select switch at
25 block 152 has been actuated or the back select switch at block 154 has been actuated or the up arrow as indicated by block 156 has been actuated. If the down arrow select switch has not been actuated at block 148, the program returns to the current address display as shown at block 122. If the arrow up select switch has been actuated as indicated by an affirmative decision at block 156 or the back select switch activated, the
30 program returns to the current address display of Fig. 9 indicated at block 122.

Thus, the flow diagram of the program of Figs. 22A-22C illustrates the operation performed by the program during a sequence of operation through the menu as shown

also in Fig. 5, as well as at the same time updating the location information from the GPS receiver and selected point-of-interest information, including distance to and/or direction to the selected point-of-interest information being displayed.

5 It will become apparent to those skilled in the art that various modifications to the preferred embodiment of the invention as described herein can be made without departing from the spirit or scope of the invention as defined by the appended claims.

The invention claimed is:

1. A point-of-interest memory system for use in a vehicle comprising:
a database including roadway data including highway identification information
5 including exits and location information, street names and address numbers and the
location and identification of points of interest, wherein said database has data sets
layered thereon according to road network information and separately point-of-interest
information such that said database can be updated separately at different time intervals
for separately updating the road network information and point-of-interest information.
10
2. The system as defined in claim 1 wherein said database is programmed into a
programmable memory.
3. The system as defined in claim 2 wherein said programmable memory is a
15 removable memory device.
4. The system as defined in claim 3 wherein said removable memory device is a
flashcard.
- 20 5. The system as defined in claim 4 wherein said system includes:
a GPS receiver;
a display; and
a microprocessor coupled to said memory, to said GPS receiver, and to said
display for displaying point-of-interest information to an operator of a vehicle in which
25 said system is installed.
6. The system as defined in claim 5 and further including at least one operator-
actuated switch coupled to said microprocessor to allow the operator to select for
individual display one of addresses on a street on which the vehicle is traveling and
30 separately cross-streets ahead and behind the vehicle.

7. The system as defined in claim 6 wherein said display of addresses further includes a display of the street name on which the vehicle is traveling.

5 8. The system as defined in claim 7 wherein said display of cross streets includes graphic lines depicting sides of a roadway and the cross streets are positioned between said lines.

9. The system as defined in claim 8 wherein said display of cross streets includes at least one arrow aligned with respect to the displayed cross streets at a position indicating the position of the vehicle with respect to said cross streets.

10

10. The system as defined in claim 9 wherein said display displays two cross streets ahead of the vehicle.

15 11. The system as defined in claim 10 wherein said display includes two arrows with an arrow positioned adjacent each graphic line representing a side of a roadway.

12. The system as defined in claim 6 and further including at least one operator actuated switch which permits the operator to select a point of interest from a menu of available points of interest when on a highway and said display displays the distance and direction to said selected point of interest.

20

13. The system as defined in claim 6 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest and said display selectively displays detailed information regarding a selected point of interest.

25

14. The system as defined in claim 12 wherein said operator-actuated switch permits the operator to selectively display the exits on a highway on which the vehicle is traveling, wherein said microprocessor is programmed to respond to operator input signals from said switch to provide a scroll-forward display of upcoming highway exits and for displaying points of interest accessible at such highway exits

30

15. The system as defined in claim 5 and further including an electronic compass coupled to said display.

5 16. The system as defined in claim 5 and further including an outside temperature sensor coupled to said display.

17. The system as defined in claim 5 and further including a trip computer coupled to said display.

1/13

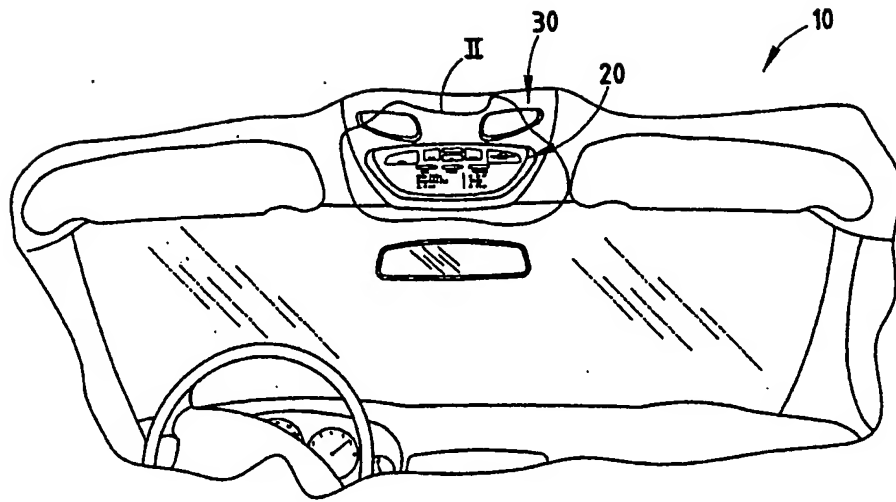


FIG. 1

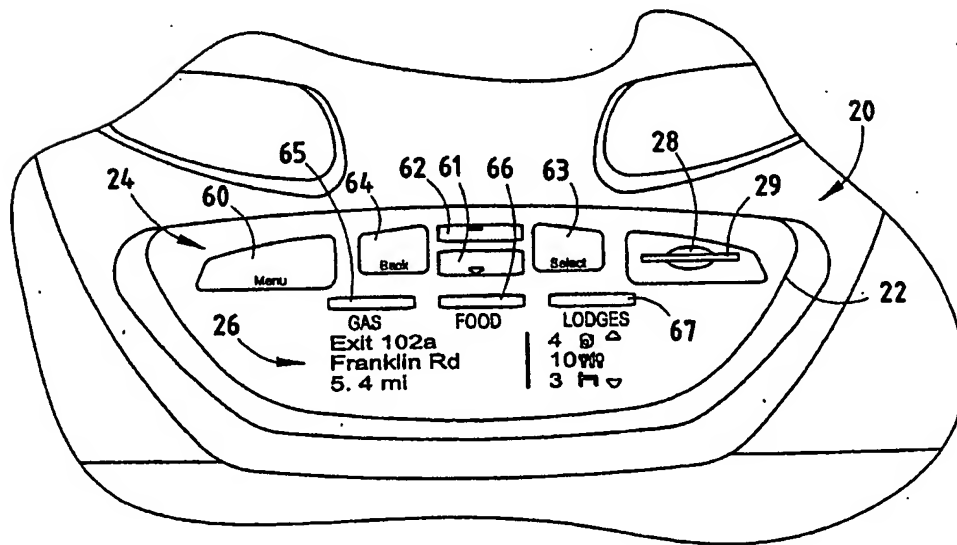


FIG. 2

2/13

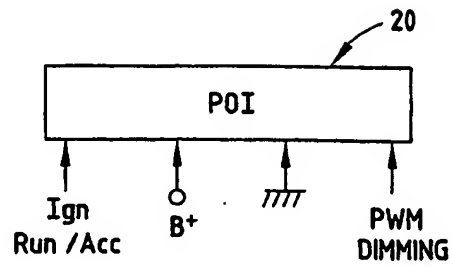


FIG. 3

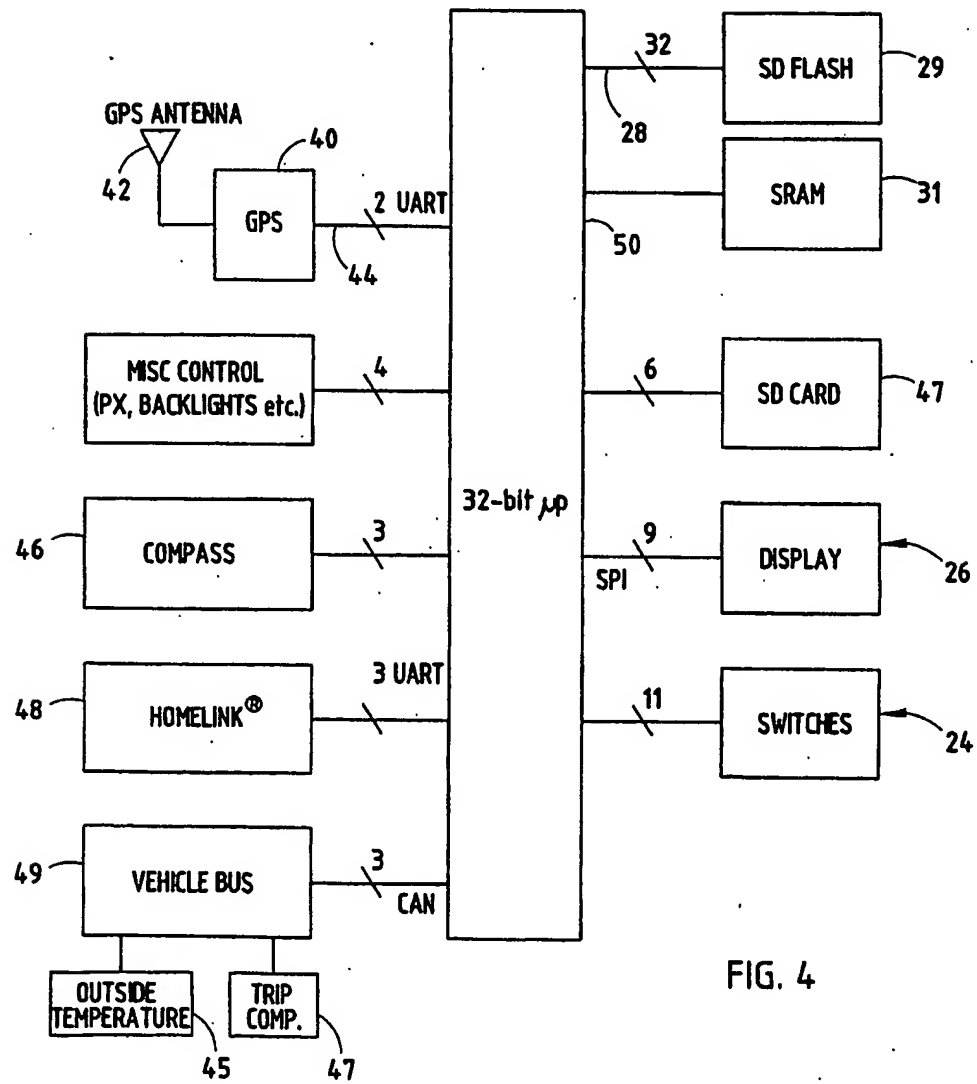


FIG. 4

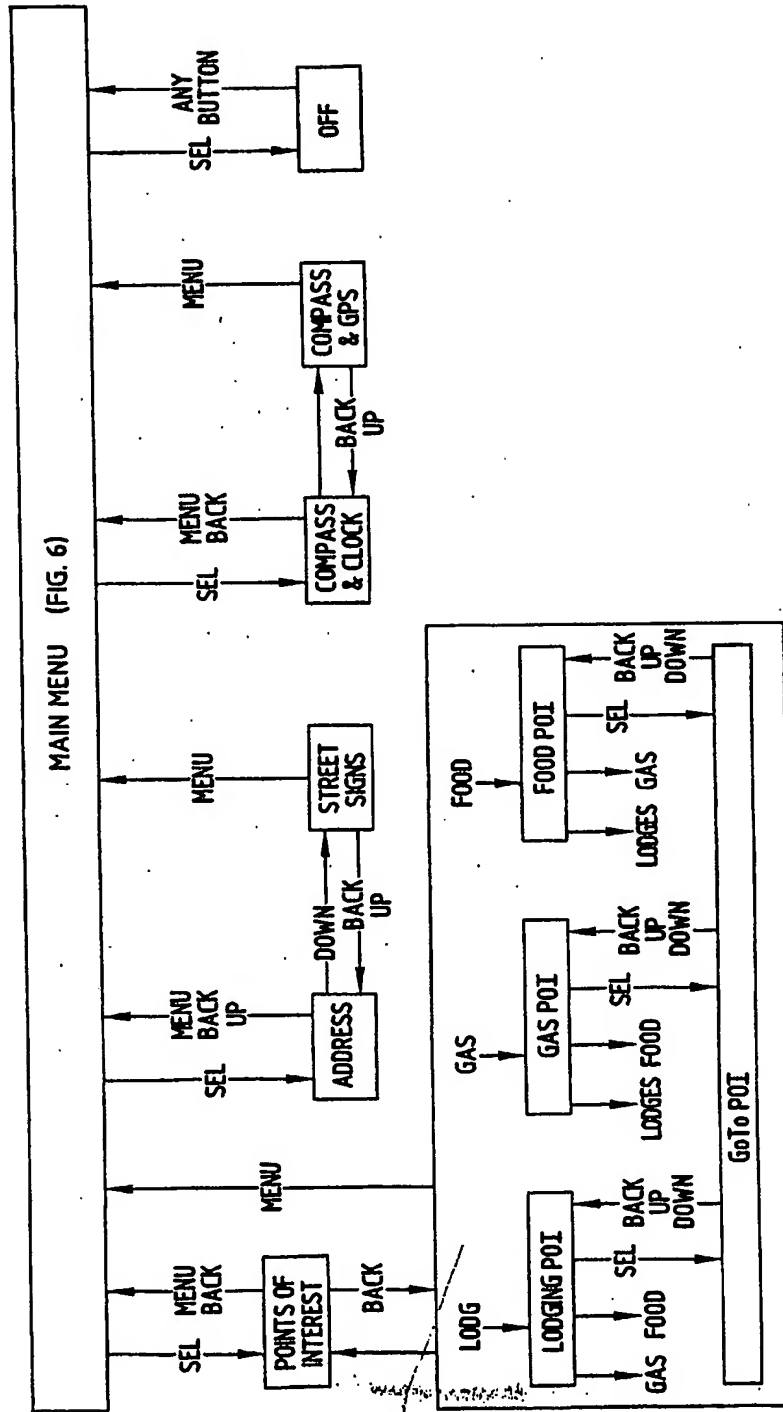


FIG. 5

4/13

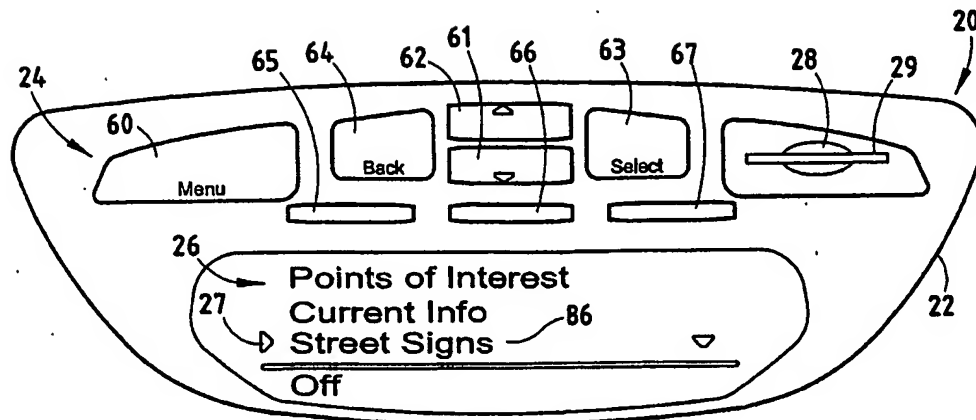


FIG. 6

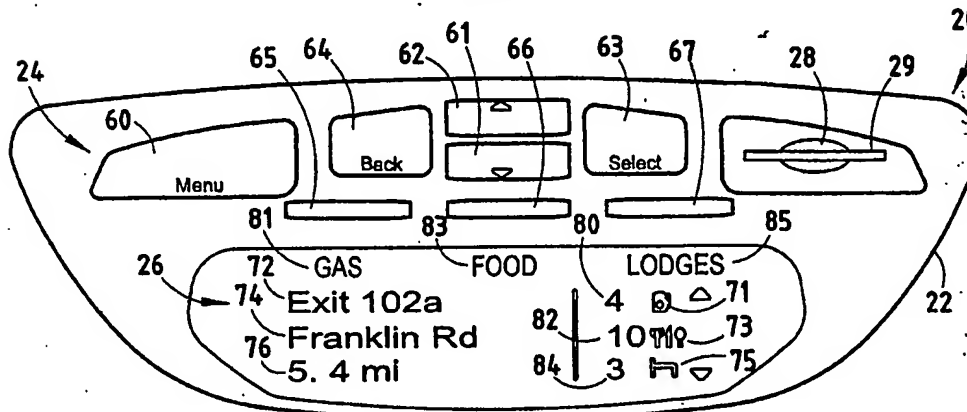


FIG. 7

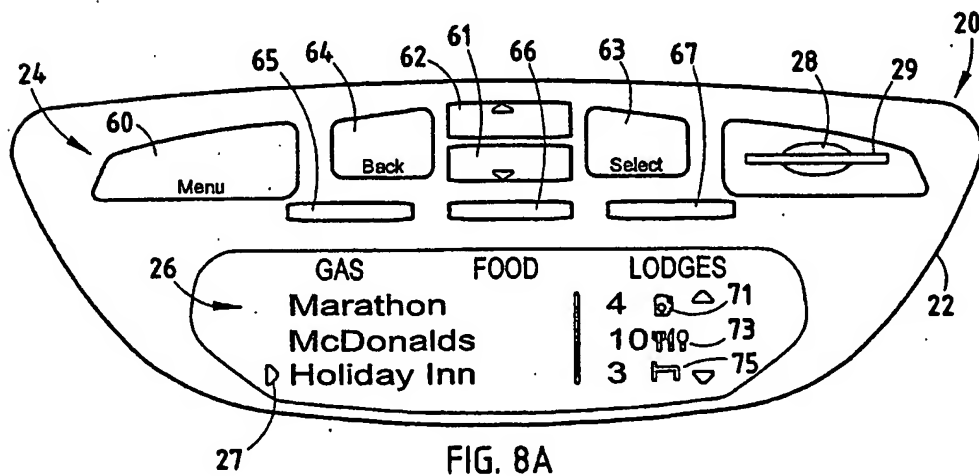
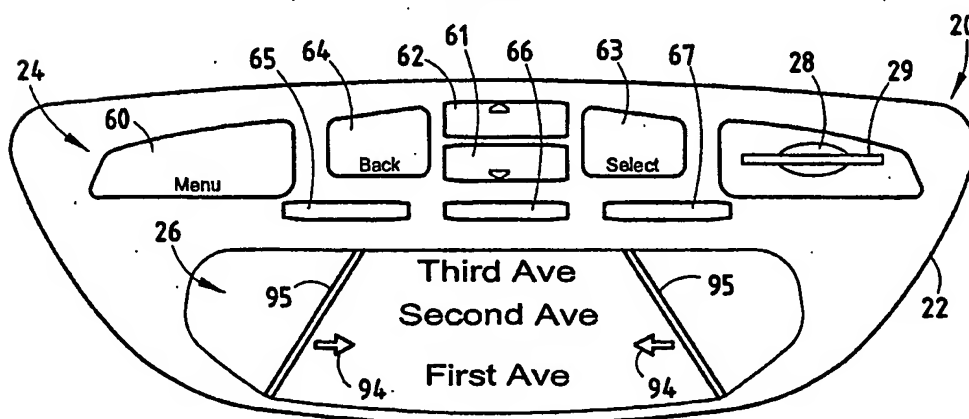
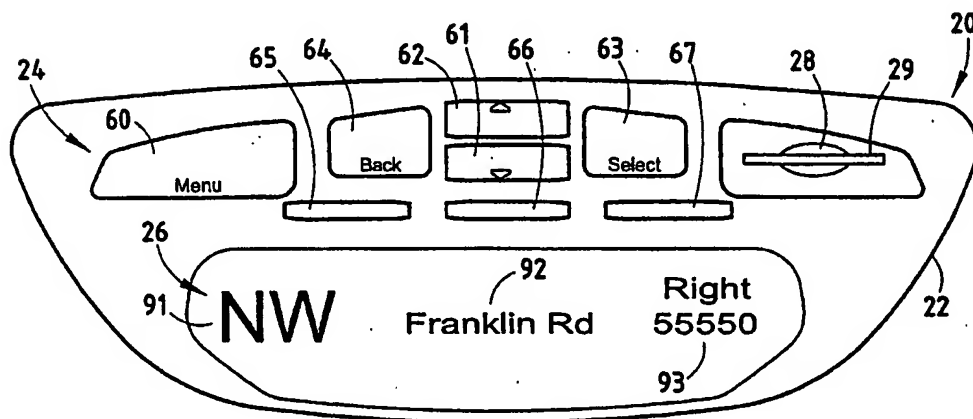
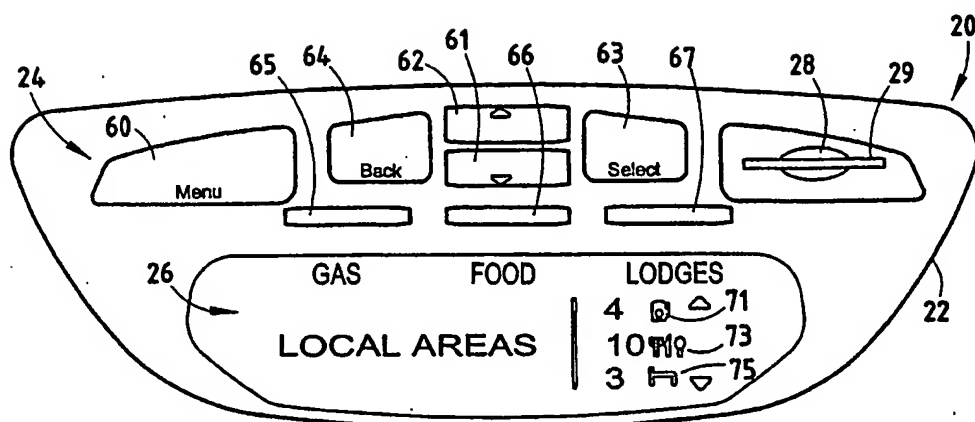


FIG. 8A

5/13



6/13

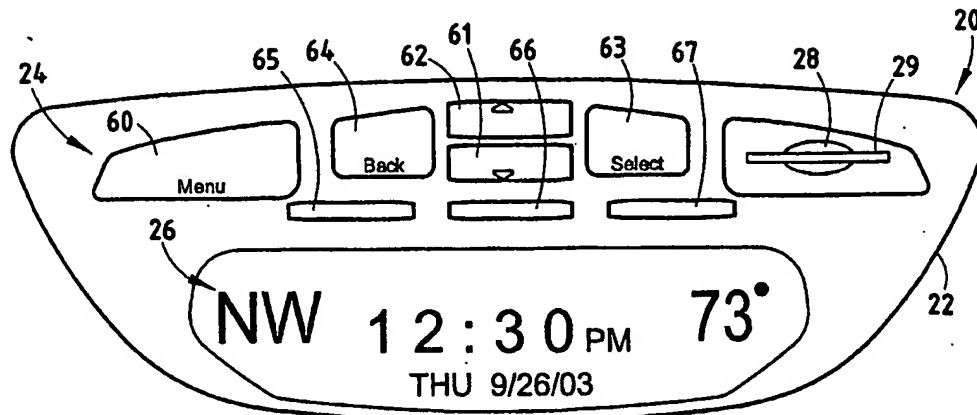


FIG. 11

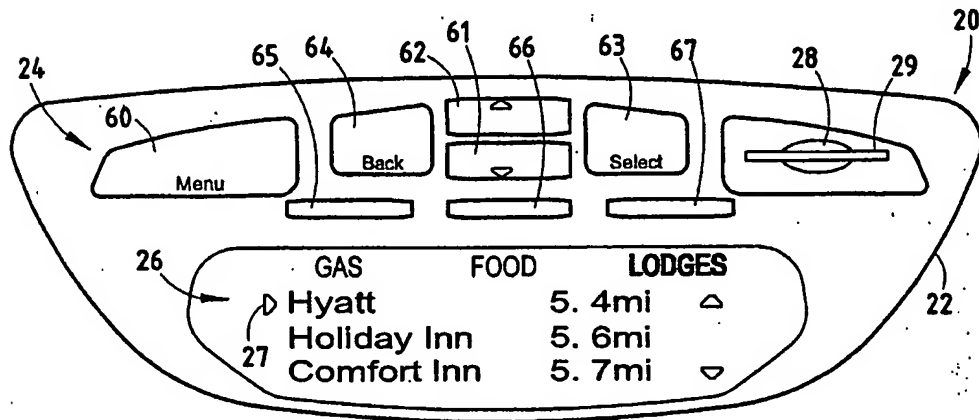


FIG. 12

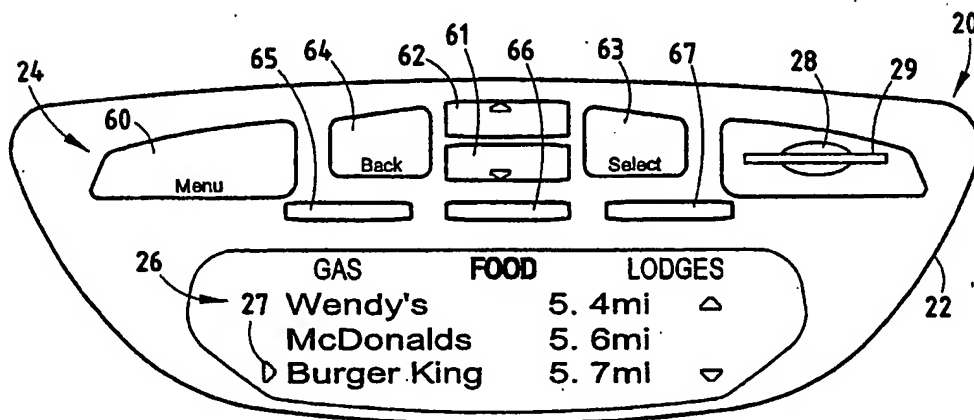


FIG. 13

7/13

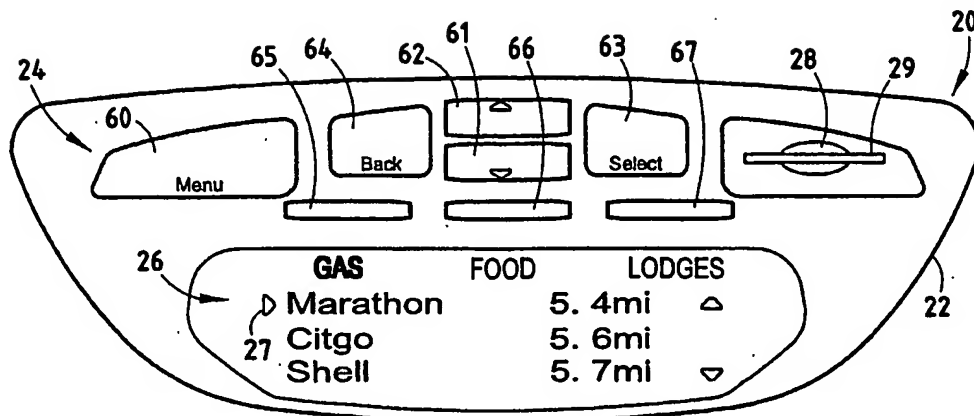


FIG. 14

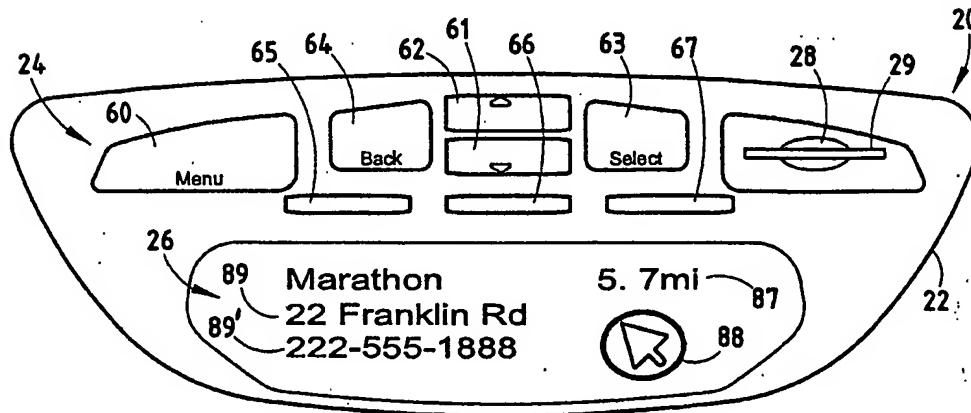


FIG. 15

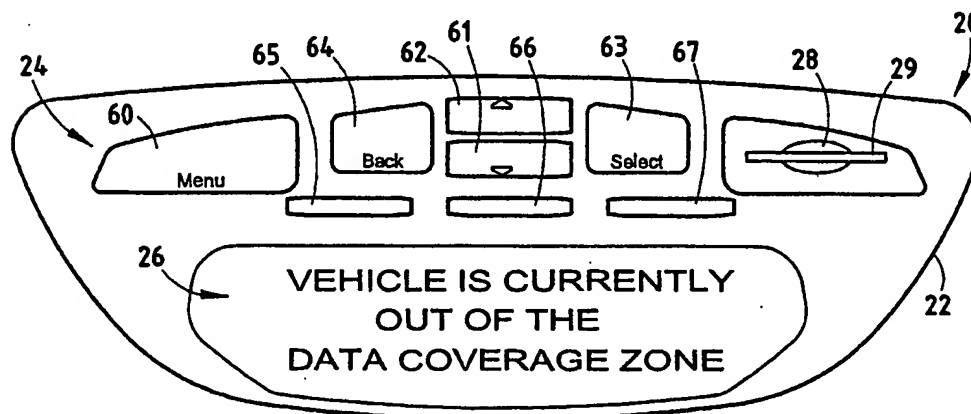


FIG. 16

8/13

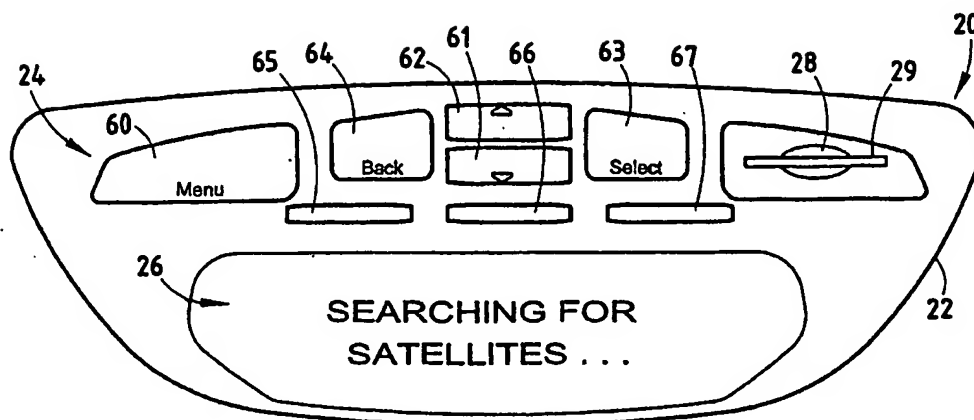


FIG. 17

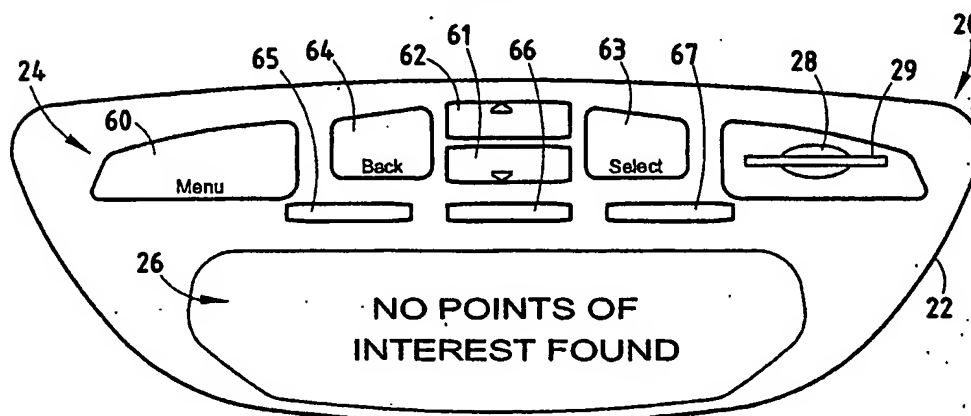


FIG. 18

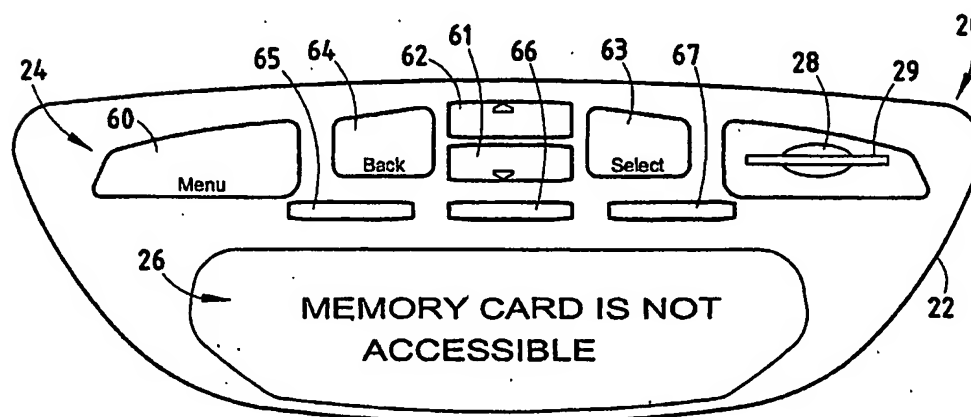


FIG. 19

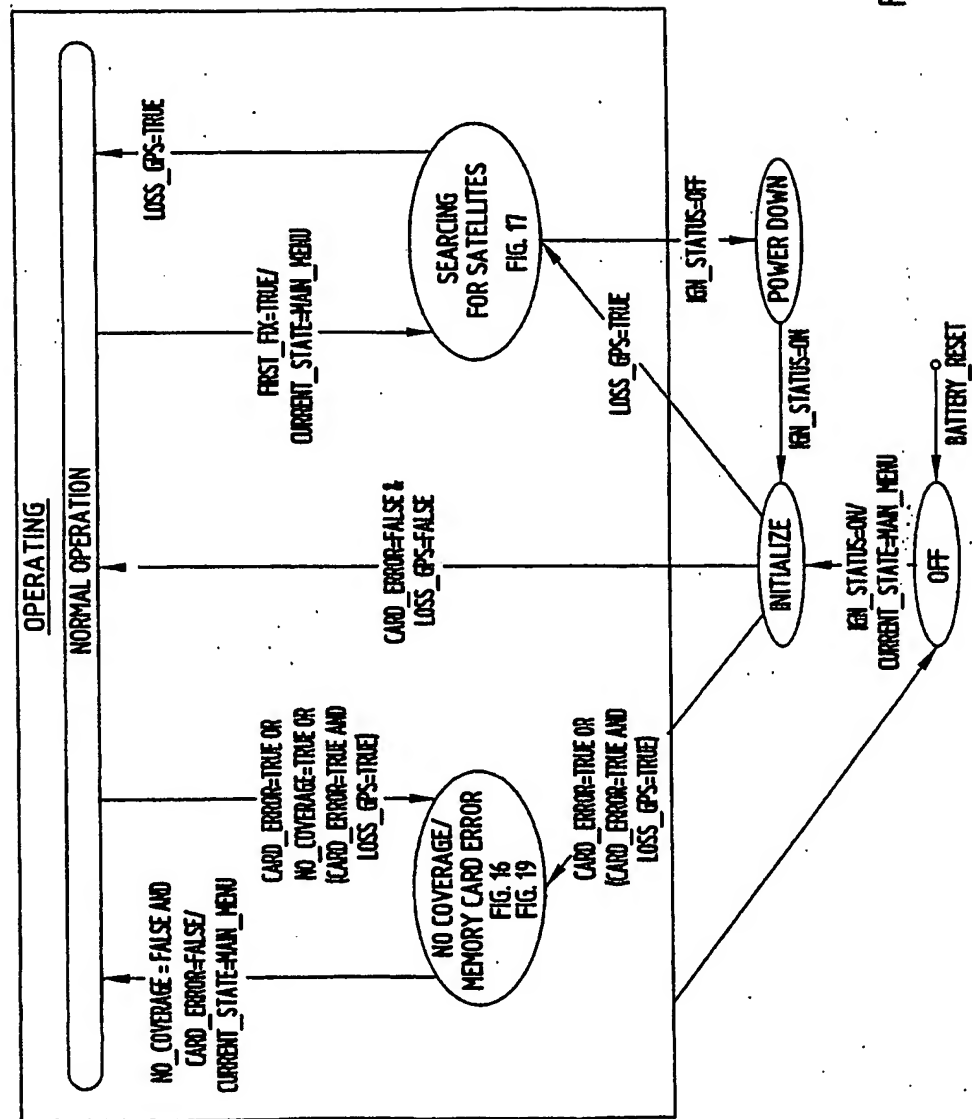


FIG. 20

10/13

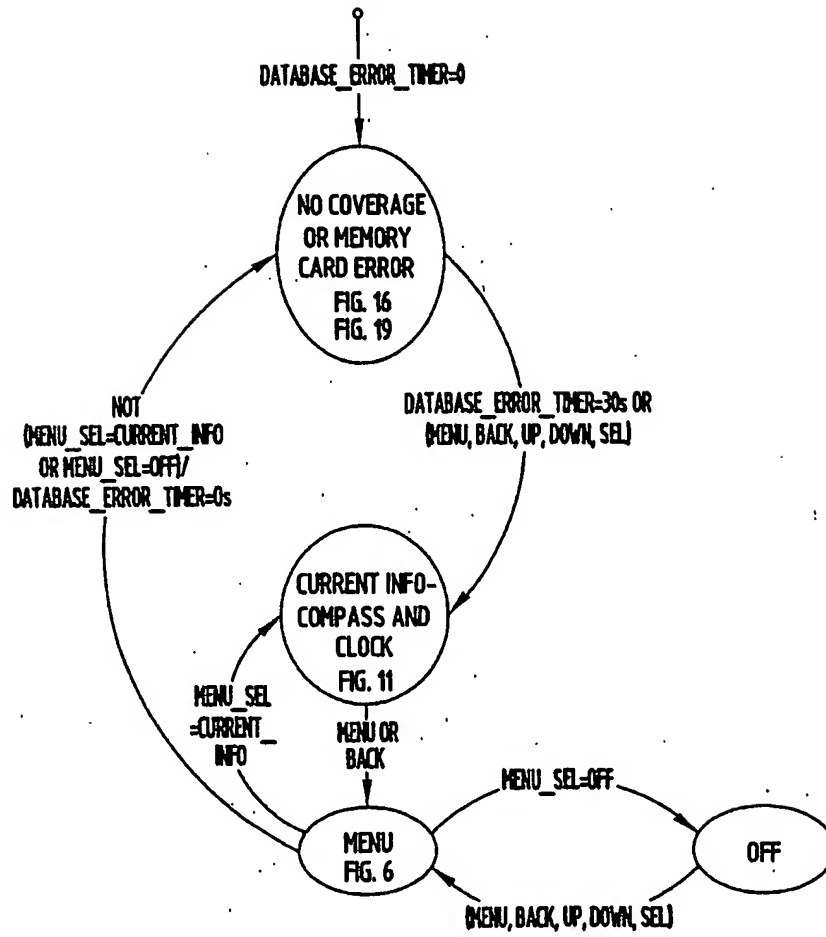


FIG. 21

11/13

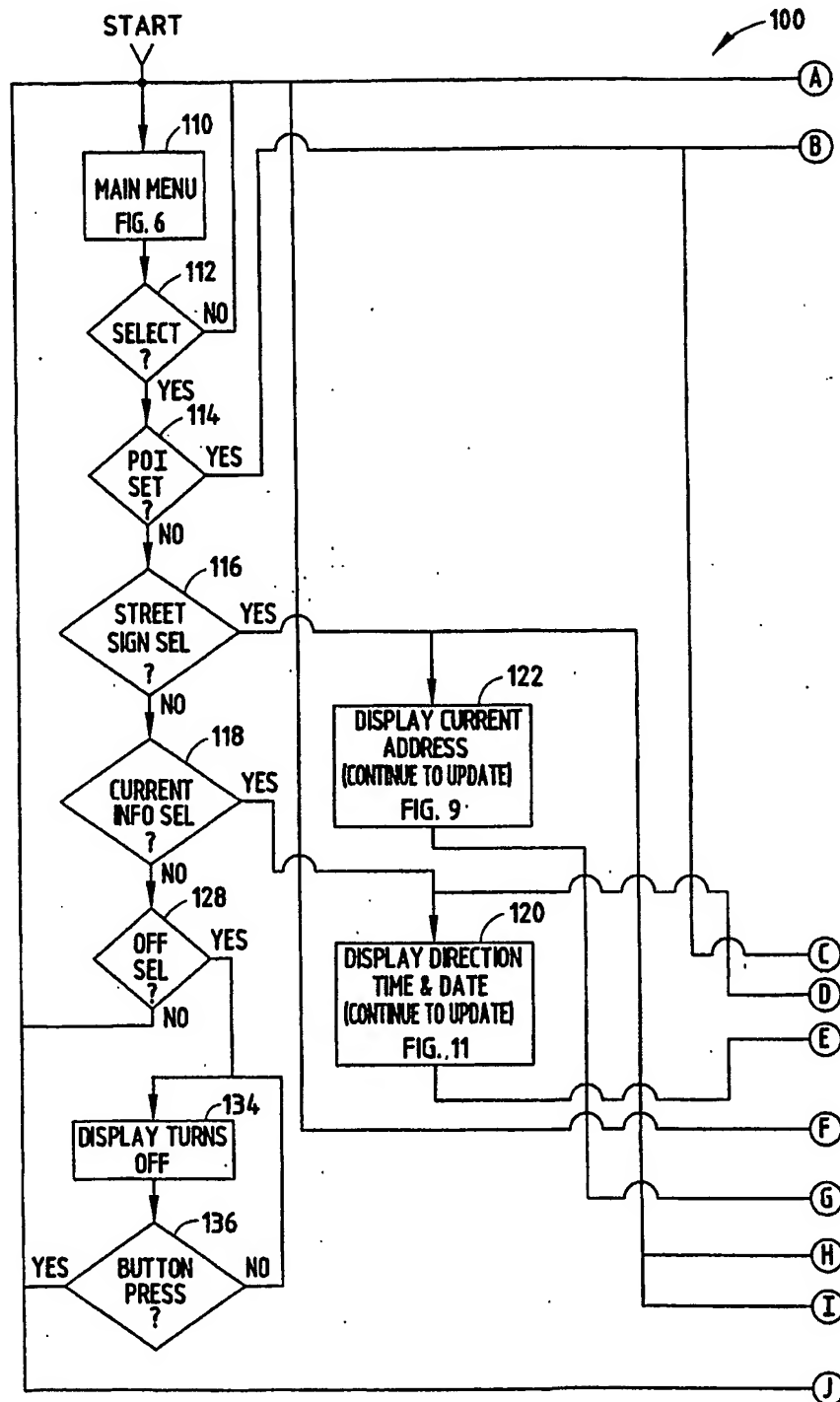


FIG. 22A

12/13

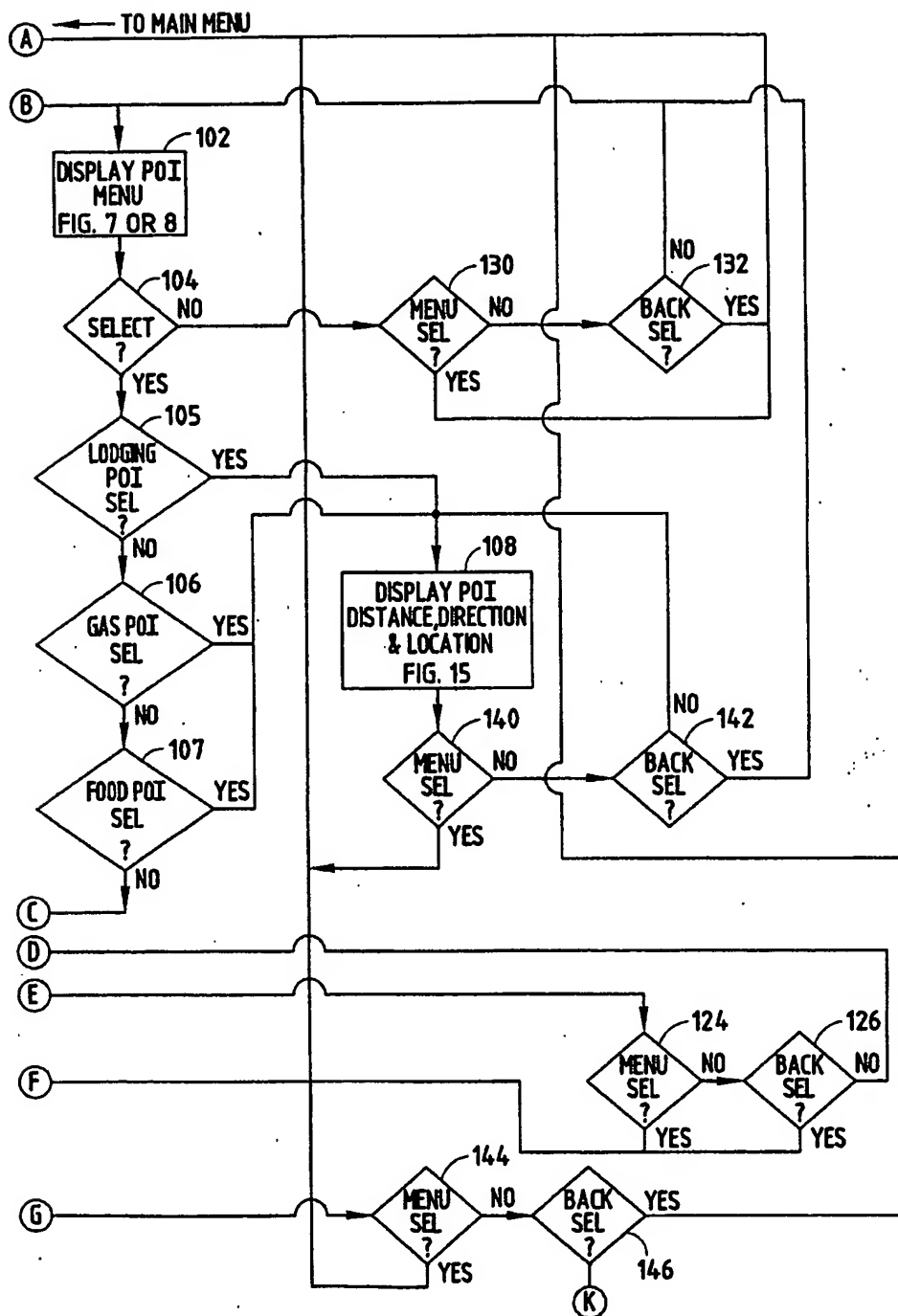


FIG. 22B

13/13

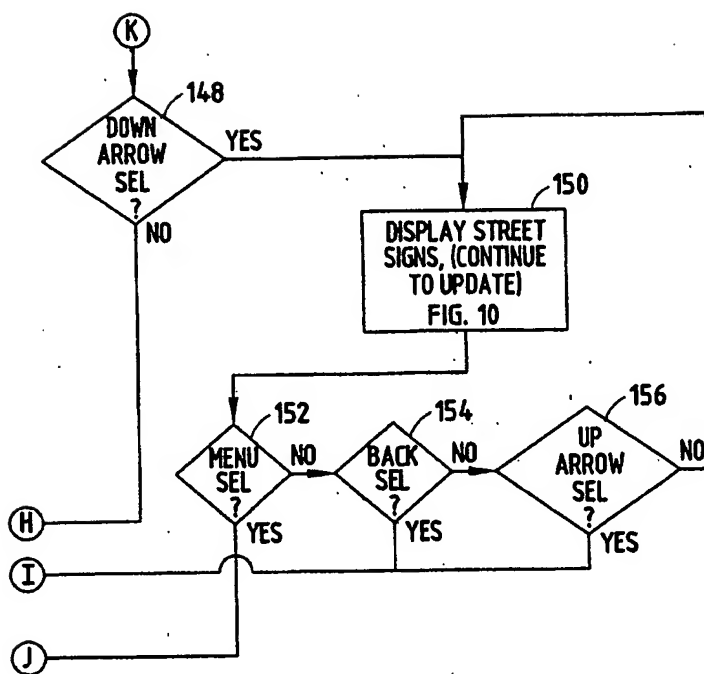


FIG. 22C

POINT-OF-INTEREST DISPLAY SYSTEM

BACKGROUND OF THE INVENTION

The present invention relates to a display system for a vehicle and particularly to one which provides a display of selected names of points of interest arranged by category and elemental directions to a selected point of interest. One embodiment provides a graphic display of cross-streets or addresses as the vehicle travels along a local roadway.

There exist numerous vehicle navigation systems which provide graphic map displays, which allow the vehicle operator, through significant manipulation of controls, to plan a travel route and obtain information about arrival destinations, typically by address. Some systems provide navigation control through the use of voice recognition programs and control circuits. All of these systems are relatively expensive, complicated and difficult for a vehicle operator to utilize, particularly when preoccupied with surrounding traffic in congested areas. Some suggested simplified navigation systems allow the vehicle operator to either identify his or her current location by street address and forthcoming intersection information, as well as basic points of interest information. Such systems are relatively inexpensive but do not provide the operator with the flexibility of providing points-of-interest information in a user-friendly format nor additional desirable features, such as easily accessible alternate displays of forthcoming highway exits, street intersections, or street addresses when traveling on a local street.

Thus, there remains a need for a display system for a vehicle which is relatively inexpensive and is user-friendly to operate using a minimum number of intuitive controls. Such a system needs to provide desirable features, such as points of interest in selected categories which can be easily accessed with minimal operator intervention and yet provide the operator with sufficient information to be able to locate and travel to such points-of-interest.

SUMMARY OF THE INVENTION

The system of the present invention satisfies this need by providing a point-of-interest display system in which an updateable database includes road network information, which can be updated at relatively infrequent time intervals, and point-of-

interest information which can be user-updated at more frequent intervals, as new points of interest become available. In a preferred embodiment of the invention, the database is carried on the vehicle in the form of a flashcard or other removable memory device or loaded into flash memory residing in the vehicle via a data communication system. The database interfaces with a microprocessor on the vehicle which receives data from a current position detector, such as a GPS receiver, providing the system with current vehicle location and direction of travel information. A display provides the operator textural and elemental graphic display information, and one or more control switches are positioned in an easily accessible location within the vehicle such that the operator, by scrolling through displayed highway exits, can select categories of points of interest, and points of interest within a category upon the actuation of a minimal number of switches in an intuitive sequence.

In one embodiment of the invention, two modes of operation provide point-of-interest information either while the vehicle is traveling on a limited access highway or, once the vehicle has exited the highway, provides more specific point-of-interest directions. In another embodiment of the invention, the operator can, when on a local road, select the textural display of forthcoming and past intersecting streets, which is updated as the vehicle travels along the roadway. In yet another embodiment of the invention, the navigation system provides a display of the street addresses on which the vehicle is traveling and increments, decrements, or otherwise updates the address as the vehicle moves. In a preferred embodiment of the invention, each of these features are incorporated in a system which allows selection between the features, either manually or automatically as the vehicle moves between a limited access highway and a local roadway.

These and other features, objects and advantages of the present invention will become apparent upon reading the following description thereof together with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a fragmentary perspective view of a vehicle having a point-of-interest display system embodying the present invention;

Fig. 2 is an enlarged fragmentary view of the system shown in Fig. 1;

Fig. 3 is a block electrical diagram showing one interface connection of the system to the vehicle power system;

Fig. 4 is a block electrical circuit diagram of the point-of-interest system including its major components;

Fig. 5 is a flow diagram showing the menu operation for operation of the system shown in Figs. 1-4;

Fig. 6 is the display screen for the main menu;

Fig. 7 is the display screen illustrating the information displayed to the vehicle operator when in a highway point-of-interest mode of operation;

Figs. 8A and 8B are alternate display screens illustrating the information displayed to the vehicle operator when in a local point-of-interest mode of operation;

Fig. 9 is the display screen illustrating the information displayed to the vehicle operator when in a street-address mode of operation;

Fig. 10 is the display screen illustrating the information displayed to the vehicle operator when in a street-sign or cross-street mode of operation;

Fig. 11 is the display screen illustrating the information displayed to the vehicle operator when in a current-information mode of operation;

Fig. 12 is the display screen illustrating the information displayed to the vehicle operator when the lodging category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 13 is the display screen illustrating the information displayed to the vehicle operator when the food category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 14 is the display screen illustrating the information displayed to the vehicle operator when the gas category has been selected in the point-of-interest modes shown in Figs. 7, 8A and/or 8B;

Fig. 15 is the display screen illustrating the information displayed to the vehicle operator when a particular point of interest in the highway mode has been selected;

Fig. 16 is the display screen illustrating the information displayed to the vehicle operator when the vehicle is out of the coverage zone;

Fig. 17 is the display screen illustrating the information displayed to the vehicle operator during initial start up when the GPS receiver is looking for satellites;

Fig. 18 is the display screen illustrating the information displayed to the vehicle operator when no point of interest was found at a selected exit;

Fig. 19 is the display screen illustrating the information displayed to the vehicle operator in the event a memory card has not been inserted into the circuit;

Fig. 20 is a flow diagram of the operation of the system during start up and shut down;

Fig. 21 is a flow diagram of the normal operation mode of the system; and

Figs. 22A, 22B, and 22C are a detailed flow diagram of the programming of the system during operation.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring initially to Fig. 1, there is shown a vehicle 10, such as an automobile, van, sports utility vehicle, truck, or the like, which incorporates a point-of-interest display system of one embodiment of the present invention. The point-of-interest display system 20 is mounted in one embodiment in an overhead console 30, although it can be mounted at any conveniently accessible location within easy reach of the vehicle operator, such as in the instrument panel. The point-of-interest system includes a switch group 24 and a display section 26, shown in detail in Fig. 2. The point-of-interest system can be mounted within a housing 22, which includes both the display 26 and switch section 24, as well as a memory card slot 28 for receiving a removable memory card 29, such as a flashcard on which the point-of-interest and road network data is programmed. Alternatively, separate mounting of the components is possible.

The memory card 29 typically will be at least a 128 meg card, although 256 or 512 meg cards may be preferred. The memory card is removable from slot 28, such that data thereon, including road network information and point-of-interest (POI) information, can be separately programmed in layers thereon, such that the road network and POI data can be refreshed at different, periodic intervals. Memory card 29 includes nonvolatile memory and contains a handshake code to communicate with a microprocessor 50 (Fig. 4) of the system, so the microprocessor can read data on the memory card 29. The system, as seen in Fig. 4, also includes a programmable SRAM memory 31, which contains the program for the sequential operation of the system, as shown in Fig. 5. The flow diagram for the program is shown in Figs. 22A, 22B, and 22C, described below. In one embodiment memory card 29 can be obtained from a car

dealer with an update subscription service for refreshing the data on the card either annually, in the case of road network information, or more frequently as new points of interest may become available, such as, for example, on a monthly basis. Alternatively, the user may subscribe to a web site providing download information for refreshing the data on memory card 29 on a personal computer if desired. Card 29 may also be updated through other means. Typically, the memory card will have data sufficient for a regional area in which the vehicle normally travels and will contain points of interest according to categories, such as gas, food, and lodging, as well as all the major (*i.e.*, limited access) and secondary road identifications and street addresses for secondary roads.

The map database is composed of at least two layers, at least one of which includes data like points of interest that change frequently. It is, therefore, desirable to update this information frequently. Another layer or layers of data contain information like the road network that may be undated less frequently. The data layers are linked and each layer may be updated either independently or in combination with other layers. This allows the consumer to obtain updated information without excessive download time when refreshing the data through the Internet, since the update can be limited to the part of the data that changes frequently.

Each layer is contained within a single file on the flashcard 29 for a given geographical area. Every POI record, whether for highway or local coverage, references a street name record in the road network file. This reference is stored in the POI file as an index into the street name table in the road network file.

As the latest POI information is released and compiled, every POI file that is created is associated with the latest road network file available. In addition, any new points of interest that are associated with roads that are not yet compiled into the latest road network file are added to the POI file but are flagged as being without a street name. All other POI attributes, such as telephone number, latitude/longitude and name, are still available in this case. Details of some aspects of the programming of the system to provide the various modes of operation are disclosed in Application No. 60/419,934, entitled **SYSTEM AND METHOD FOR DISPLAYING VEHICLE LOCATION AND POINT OF INTEREST INFORMATION**, the disclosure of which is incorporated herein by reference and in connection with the flow diagrams of Figs. 22A-22C.

The system, as best seen in Fig. 4, includes a current location detection device, such as GPS receiver 40, having an antenna 42 for receiving global positioning satellite signals from multiple satellites and providing current location data to one or more microprocessor(s) 50, which can be a Motorola MC9512DJ64 or its equivalent, through a universal asynchronous receiver/transmitter connection 44. Other current location detection sources of data, such as a Loran receiver, gyro compass, or dead reckoning information sources, may also be employed but a GPS receiver represents the current best mode of receiving such data. The microprocessor receives vehicle location data from the GPS receiver and point-of-interest and road network data from the flashcard 29, which is inserted into slot 28 and coupled to the one or more microprocessor(s) 50. An SRAM memory 31 is also coupled to the microprocessor(s) 50 and contains the system program. The microprocessor is also coupled to one or more operator-actuated switches in the switch section 24 and to a display 26, such as a dot matrix display, for selectively displaying information, such as shown in Figs. 2 and 6-19, to the vehicle operator.

The point-of-interest circuit 20 is coupled to the vehicle power system, as shown in Fig. 3, and includes an ignition input for receiving power when the ignition is either in the run or accessory position, a B+ input drawing a maximum of 300 micro amps when the system is deactivated, a coupling to the system ground and a pulse width modulated dimming input circuit for dimming the back-lighted switches of the switch bank 24 and the dot matrix display 26 based upon the operator's selected lighting level for instrument displays. In some installations, the system could be coupled directly to the vehicle's power supply through the ignition switch and vehicle ground. In another, dimming information is received from the vehicle bus. The microprocessor 50 is also coupled to other vehicle systems, such as a vehicle compass 46 for displaying in the normal mode of operation, when the point-of-interest system is not being employed, the outside temperature, the compass heading, the time and date information, as seen in Fig. 11. The microprocessor may also be coupled to and employed for other vehicle control functions, such as a Homelink® brand programmable transmitter 48, and may be coupled to the vehicle bus 49 for receiving PWM dimming information, ignition run, accessory information, and the like. An outside temperature sensor and circuit 45 may be coupled to the microprocessor(s) 50 or the vehicle bus 49, as shown in Fig. 4, to provide the

temperature display as seen in Fig. 11. Also, a trip computer 47 may be coupled to the microprocessor(s) 50 or to the vehicle bus 49, as shown in Fig. 4, to provide typical trip functions, such as a resettable odometer, fuel consumption, average speed, and estimated time of arrival information, which can be displayed on display 26.

The user-friendly, intuitive switch controls 24 are seen in Fig. 2 and incorporate a menu switch 60, a scroll forward switch 61, a scroll back switch 62, which are physically positioned on the console pointing in a forward and rearward position, respectively, with arrows thereon so as to intuitively indicate to the vehicle operator that the actuation of the scroll switches advances the display to a point of interest or highway exit forward or behind the vehicle. The switch controls 24 also includes a select switch 63 for selecting a given entry highlighted by the movement of a display cursor 27 (Fig. 8) through actuation of scroll switches 61 and 62 and a back switch 64, which allows the operator to move back one entry. Additionally, keys 65, 66, and 67 are provided and are aligned with display icons showing "gas", "food", and "lodges", respectively, as seen in Fig. 2. When the system is employed with a HomeLink® brand trainable transmitter, the switches can, when the POI system is off (Fig. 6), provide the dual function of operating any one of the three programmed transmitting frequencies and codes for up to three different garage doors, home appliances, security gates, or the like.

The operation of the system seen in Figs. 1-4 is best understood by reference to the program flow diagram of Figs. 22A, 22B, and 22C together with the menu diagram with Fig. 5 in connection with the displayed information, as seen in Figs. 2 and 6-19. Initially, when this system is powered up, as shown in Fig. 20, the system searches for satellites and displays a message, as shown by Fig. 17. In the event a memory card or flashcard 29 has not been inserted, the system displays the message shown in Fig. 19, either that the "memory card is not inserted" or the message shown in Fig. 16, that "the vehicle is out of the current data coverage zone." Assuming the memory card is in place and the vehicle is in the data coverage zone and satellite signals have been received, the display screen of Fig. 6 is displayed allowing the operator the option of selecting points of interest (POI) by scrolling, utilizing switches 61 and 62, current information which provides any combination of the compass heading, time, date, and/or outside temperature information of Fig. 11 or trip computer information (not shown). The operator may also select the street sign selection showing either the address of a street on

which the vehicle is traveling, if on a secondary road, as shown by Fig. 9, or, if the scroll button is advanced and street signs has previously been selected, to the street sign display of Fig. 10.

Assuming the vehicle is on a limited access highway and the operator has selected "points of interest" by scrolling to move the cursor 27, shown in Fig. 6, to the "points of interest" selection, the operator enters select by actuating switch 63, and the highway point-of-interest mode, as shown in Figs. 2 and 7, is displayed on display 26. Such display provides information as to points of interest according to categories of gas, food, or lodging, which are displayed as shown by display icons 71, 73, and 75 in Figs. 2 and 7. Display 26 also displays the forthcoming exit which the vehicle is approaching, as indicated by display area 72 (Fig. 7), the name of the street associated with the exit, as indicated by display element 74, and the distance to the exit, as shown by display element 76. To the left of display icons 71, 73, and 75 is a numerical display 80 for indicating the number of gasoline stations available at that exit (*i.e.*, 4 for exit 102a), a numerical display 82 indicating the number of restaurants available at that exit (*i.e.*, 10), and a numerical display 84 indicating the number of lodges or sleeping accommodations available at that exit (*i.e.*, 3). By actuating scroll switches 61 or 62, the operator can scroll forward to display, for example, the information available at the next exit (No. 103, for example) or the previous exit (No. 101, for example) if at exit 102 a desired POI is not available. Thus, while in the highway POI mode, the vehicle operator can look ahead or behind for points of interest and, as discussed below, select and review available points of interest at a selected exit. This enables the operator to find, for example, a favorite restaurant while traveling when meal time is approaching.

As the vehicle travels along the highway, the operator can actuate any one of the three keys 65, 66, or 67 aligned above the display 81 of "gas", display 83 of "food", or display 85 of "lodges", respectively, to select details of the establishments in the available categories at a selected exit. Thus, if the gas key 65 is actuated, the display of Fig. 14 appears, and the "gas" icon 81 is illuminated. The display of Fig. 14 provides three service stations available at the selected exit and their distance. A similar display presentation for restaurants is shown in Fig. 13 and for lodging is shown in Fig. 12.

The operator then can scroll to the desired establishment, such as a Marathon station, as shown in Fig. 14, by actuation of switches 61 and 62 and select the

establishment aligned with the cursor 27 to be presented with a more detailed route to point-of-interest display, as shown in Fig. 15. In Fig. 15, the operator has scrolled up to the Marathon station and actuated the select switch 63. The detail display 87 shows the distance to the Marathon station (*i.e.*, 5.7 miles), and an arrow 88 shows the general direction of the station. The street address 89 of the service station, as well as its telephone number 89'. As the vehicle travels to the exit from which the POI was selected in the highway mode, this information is dynamically updated. Thus, arrow 88 changes direction and the distance information 87 of Fig. 15 is continuously updated. The distance displayed is the combined distance to the exit and from the exit to the Marathon station.

When the vehicle exits the highway, for example, at exit 102A, as shown in Fig. 7, the microprocessor detects from GPS signal and stored road network data programmed in the memory 31 that it is on a secondary road and automatically switches to one of the local point-of-interest displays shown in Figs. 8A or 8B, which, unless a POI has previously been selected as seen in Fig. 15, automatically displays the categories of points of interest available, the number of points of interest in each category through the icons 71, 73, and 75, and the nearest points of interest within a selectable range of, for example, two to four miles of the nearest points of interest regardless of the category. Again, the operator can select any one of the categories by actuating the switches 65, 66, and 67 after which the selected category will be displayed as shown in Figs. 12-14, and a go-to point of interest can be selected by movement of the cursor through actuation switches 61 and 62 and entry of a highlighted point of interest by select switch 63 to obtain the information for that point of interest, as represented, for example, by Fig. 15. If a POI had previously been selected, the display of Fig. 15 remains displayed to the operator.

If there are no points of interest found at a forthcoming exit, the display of Fig. 18 is displayed to the vehicle operator indicating that, at that exit, no selected category points of interest are available. The operator can either scroll forward to exits ahead of the vehicle or scroll backward using switches 61, 62 to a previous exit to look for a desired point of interest and determine which is the closest point of interest which satisfies the operator's needs. If on a local road and no POI are found within an initial

search range, the system will expand the search range until a POI is found and display either the Fig. 8A or Fig. 8B display to the operator.

In addition to the point-of-interest mode of operation, the operator can enter the street sign mode from the main menu by pushing the menu switch 60 and scrolling to street signs (Fig. 6). By actuating the select switch 63, the display of Fig. 9 is presented to the operator, which shows the direction 91 of travel of the vehicle, the road 92 on which the vehicle is traveling, and a street address display 93, which shows the street numbers and which increments or decrements as the vehicle travels along the street, to provide the operator with the ability to locate a point of interest which may have previously been identified by street number or is otherwise known to the operator. This display is particularly helpful where the point of interest is set back from the road, such as, for example, in a shopping mall or the like, and the address is not readily visible from the road. As is well known, the displayed address is interpolated from two known locations and the current vehicle position with respect to such locations as determined by the GPS information.

If the operator scrolls forward utilizing switch 61 while in the street sign mode displaying addresses, as shown in Fig. 9, the system enters the display of cross streets, as shown in Fig. 10, in which two streets ahead of the vehicle (*e.g.*, Second Avenue and Third Avenue in Fig. 10) are presented, as are arrows 94 indicating the location of the vehicle between Second Avenue and recently passed First Avenue. This provides the operator with an easily recognizable display of cross streets on a roadway defined by converging graphic lines 95, which includes arrows 94 to provide a clear graphic diagram to the vehicle operator as to the vehicle's location with respect to forthcoming cross streets. In the event that the area does not provide cross-street information or street addresses for a given location of the vehicle, a display is provided to the operator, indicating that such information is not available and the operator must return to the main menu and enter the highway or local point-of-interest mode for guidance. The operator can always select the current information display of Fig. 11 by actuating the back button 64 when in any of the other modes until the information is displayed or actuate the menu button and actuate cursor switches 61, 62 to align cursor 27 with current information and actuate the select switch 63 to provide the compass, temperature, time, and date information display of Fig. 11.

Fig. 5 illustrates the various operational modes described above by the actuation of the select, menu, back, scroll, and POI switches to select points of interest, select a category contained within the points of interest, identify a particular establishment in that category, and go to the point-of-interest display, which provides detailed information as to how to approach the selected point of interest. The flow diagram 100 of Figs. 22A, 22B, and 22C represents the programming of the microprocessor through the program contained in memory 31 of Fig. 4 to detect the actuation states of the various operator-actuated switches look at the data from the GPS receiver 40 and the flash memory 29 and display the resultant selected display information. The figure numbers of the display figures are included in the flow diagram 100.

Turning initially to Fig. 22A, the main menu 110 of Fig. 6 is displayed and the program looks at block 112 to determine if a highlighted entry has been selected and, if it has, whether the point of interest has been selected at block 114. If a point of interest display has been selected, the program moves to block 102 (Fig. 22B) and displays the point-of-interest menu of Fig. 7 or Fig. 8, depending on the location of the vehicle, either on a limited access highway or on a local roadway. If no entry has been selected in block 112, the program cycles through the main menu until such time as something has been selected by scrolling to and highlighting a desired entry. If no point of interest has been selected, the program detects at block 116 whether the street sign has been selected and, if not, at block 118, whether the current information has been selected. If current information has been selected, the display of Fig. 11 is presented, as shown by block 120. If street signs has been selected, the display of current address of Fig. 9 is presented as shown by block 122. If street signs is not selected and current information is, the program automatically updates from the data received from the compass, temperature sensor, and internal clock the information displayed in Fig. 11. The program then continues to detect at blocks 124 and 126 (Fig. 22B) whether or not menu or back has been selected. If not, it remains with the current display of Fig. 11.

If, at block 118, current information has not been selected, the program tests at block 128, whether the off selection has been entered and, if not, the program returns to the main menu 110. If off has been selected at block 128, the display is turned off, as indicated by block 134 (Fig. 22A), and the system is idle until such time as any switch

has been depressed, as indicated by block 136. When this occurs, the program returns to the main menu block 110 of Fig. 22A.

If a point of interest display has been actuated as indicated by an affirmative decision in block 114, the program moves to block 102 (Fig. 22B), displaying either the Fig. 7 or Fig. 8 menu, as indicated above. If a point of interest is not selected as indicated by a no decision in block 104, the program continues to look to see if menu or back has been selected at 130, 132 and, if not, cycles through the loop, including blocks 102 and 104, until such time as either a lodging point-of-interest key 67 (Fig. 2) has been actuated as indicated by block 105, a gas point-of-interest key 65 (Fig. 2) has been actuated, or a food point-of-interest key 66 has been selected as indicated by blocks 105-107, respectively, in Fig. 22B. If one of these categories has been selected as indicated by block 108, the point of interest distance, direction, and location of Fig. 15 is displayed. The program then detects whether a menu or back select switches have been actuated at blocks 140 and 142 and, if so, the program returns to either the main menu or displays the point-of-interest menu, as indicated in block 102.

If "street signs" is selected as indicated in block 116 (Fig. 22A) and the address of Fig. 9 is displayed, the program tests to determine if a menu select or back select switch has been actuated as indicated by blocks 144 and 146 (Fig. 22B). If the menu select switch has been actuated, the program returns to the main menu of block 110. If not and the back select switch has been actuated by an affirmative decision in block 142, the program also returns to the main menu. If the back select switch has not been actuated, the program tests to determine if the down arrow at block 148 has been actuated. If it has, the program displays the street sign mode of Fig. 10, as shown at block 150 and continues to display that until such time as either the menu select switch at block 152 has been actuated or the back select switch at block 154 has been actuated or the up arrow as indicated by block 156 has been actuated. If the down arrow select switch has not been actuated at block 148, the program returns to the current address display as shown at block 122. If the arrow up select switch has been actuated as indicated by an affirmative decision at block 156 or the back select switch activated, the program returns to the current address display of Fig. 9 indicated at block 122.

Thus, the flow diagram of the program of Figs. 22A-22C illustrates the operation performed by the program during a sequence of operation through the menu as shown

also in Fig. 5, as well as at the same time updating the location information from the GPS receiver and selected point-of-interest information, including distance to and/or direction to the selected point-of-interest information being displayed.

It will become apparent to those skilled in the art that various modifications to the preferred embodiment of the invention as described herein can be made without departing from the spirit or scope of the invention as defined by the appended claims.

The invention claimed is:

1. A vehicle display system comprising:
 - a current location detector for providing data representing the vehicle's current position;
 - a database of road network information including street names and addresses along the streets thereon;
 - a microprocessor coupled to said detector and to said database for providing display output signals representing location information as the vehicle moves along a street;
 - a display coupled to said microprocessor for displaying information selected by an operator; and
 - at least one operator-actuated switch coupled to said microprocessor to allow the operator to select for individual display one of said addresses on a street on which the vehicle is traveling and cross-streets ahead and behind the vehicle.
2. The vehicle display system as defined in claim 1 wherein said detector is a GPS receiver.
3. The vehicle display system as defined in claim 2 wherein said display of addresses further includes a display of the street name on which the vehicle is traveling.
4. The vehicle display system as defined in claim 2 wherein said display of cross streets includes graphic lines depicting sides of a roadway and the cross streets are positioned between said lines.
5. The vehicle display system as defined in claim 4 wherein said display of cross streets includes at least one arrow aligned with respect to the displayed cross streets at a position indicating the position of the vehicle with respect to said cross streets.
6. The vehicle display system as defined in claim 5 wherein said display displays two cross streets ahead of the vehicle.

7. The vehicle display system as defined in claim 6 wherein said display includes two arrows with an arrow positioned adjacent each graphic line representing a side of a roadway.

8. The vehicle display system as defined in claim 1 wherein said database further includes points of interest and wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest when on a highway and said display displays the distance and direction to said selected point of interest and after exiting a highway said display selectively displays detailed information regarding a selected point of interest.

9. The vehicle display system as defined in claim 8 wherein said database has data sets layered thereon according to road network information and point-of-interest information such that said memory can be updated separately at different time intervals for separately updating the road network information and point-of-interest information.

10. The vehicle display system as defined in claim 1 wherein said database has data sets layered thereon according to road network information and point-of-interest information such that said memory can be updated separately at different time intervals for separately updating the road network information and point-of-interest information.

11. The vehicle display system as defined in claim 1 wherein said database further includes points of interest and wherein said operator-actuated switch permits the operator to selectively display the exits on a highway on which the vehicle is traveling, wherein said microprocessor is programmed to respond to operator input signals from said switch to provide a scroll-forward display of upcoming highway exits and for displaying points of interest accessible at such highway exits.

12. The system as defined in claim 1 wherein said operator-actuated switch permits the operator to select a point of interest from a menu of available points of interest and said display selectively displays detailed information regarding a selected point of interest.

13. The system as defined in claim 1 and further including an electronic compass coupled to said display.
14. The system as defined in claim 1 and further including an outside temperature sensor coupled to said display.
15. The system as defined in claim 1 and further including a trip computer coupled to said display.

1/13

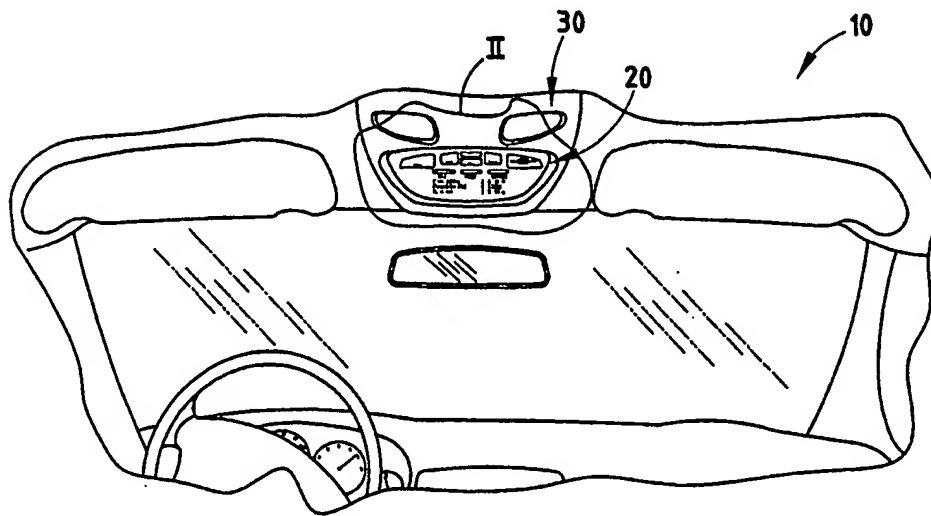


FIG. 1

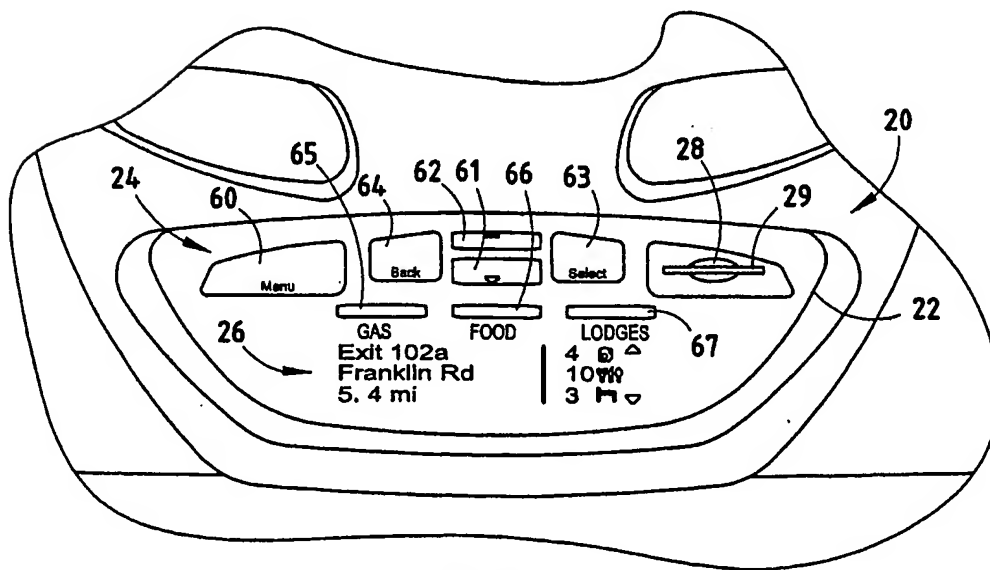


FIG. 2

2/13

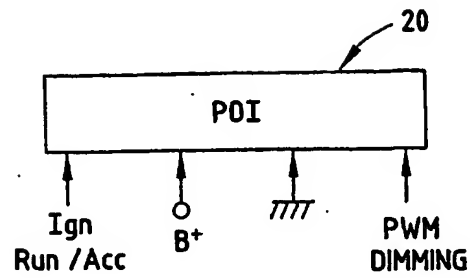


FIG. 3

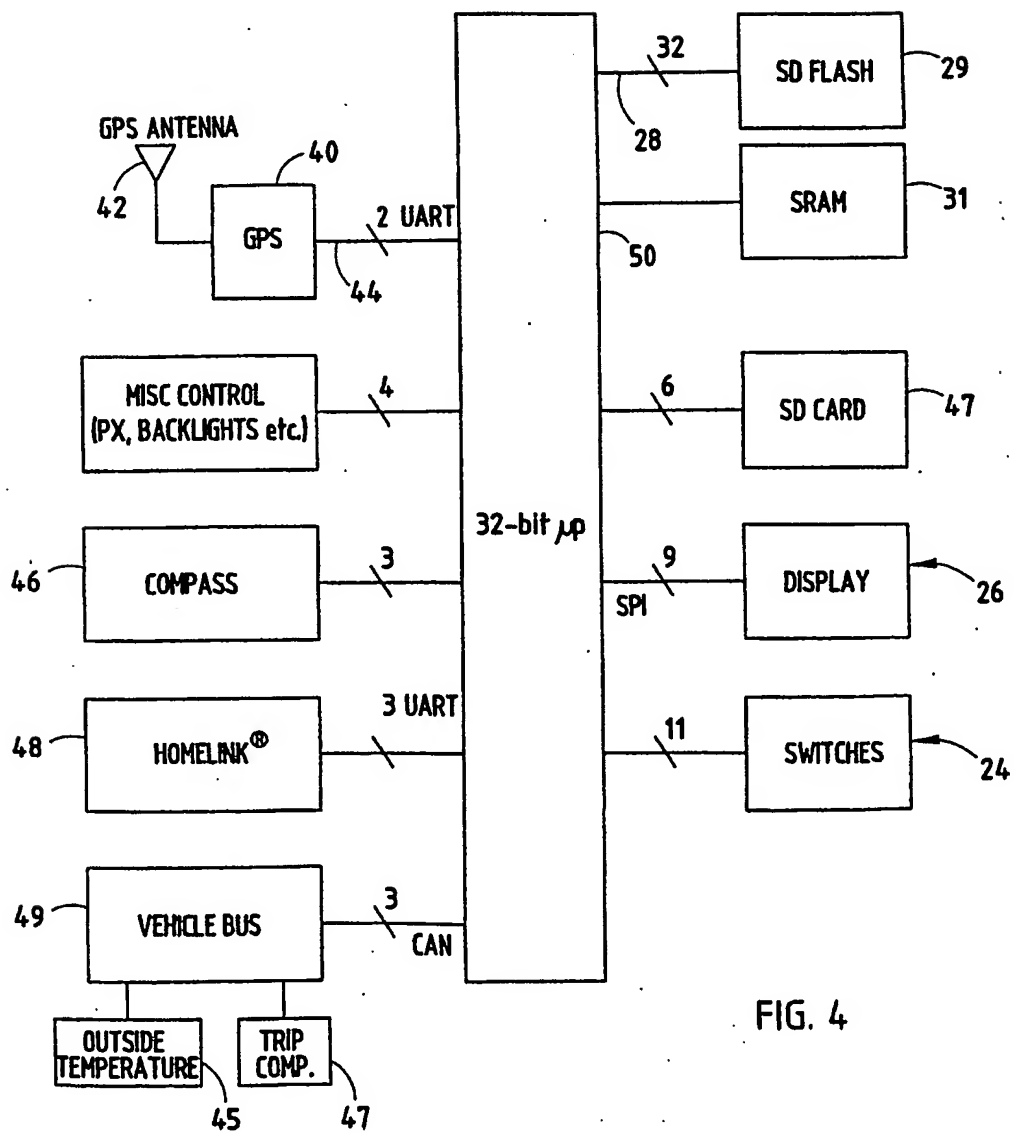


FIG. 4

3/13

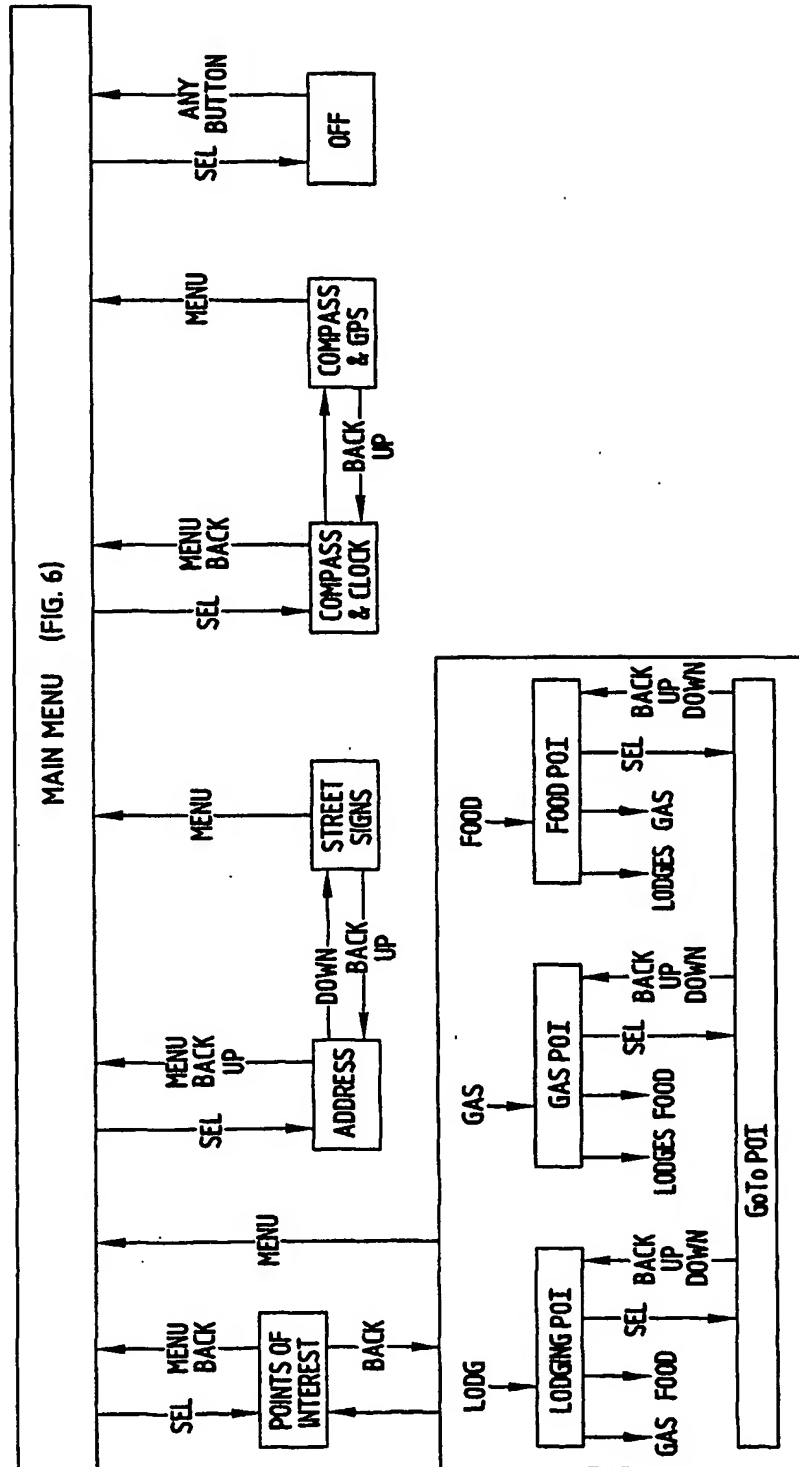


FIG. 5

4/13

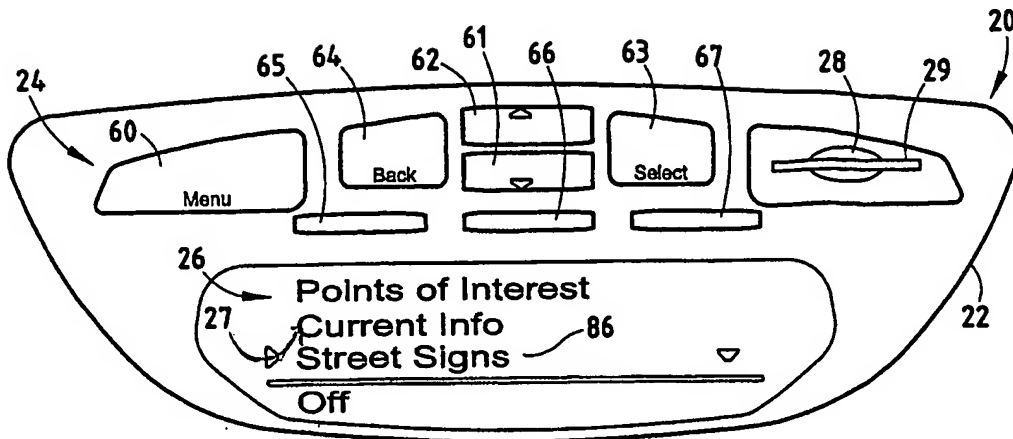


FIG. 6

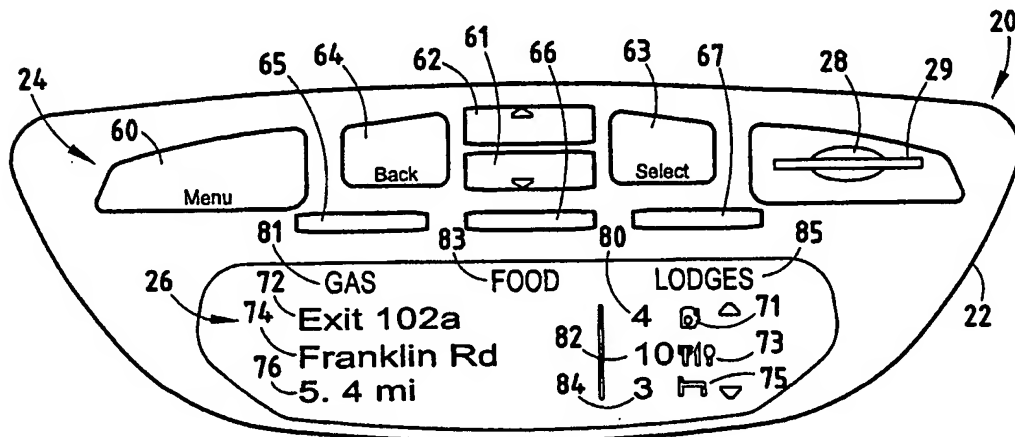


FIG. 7

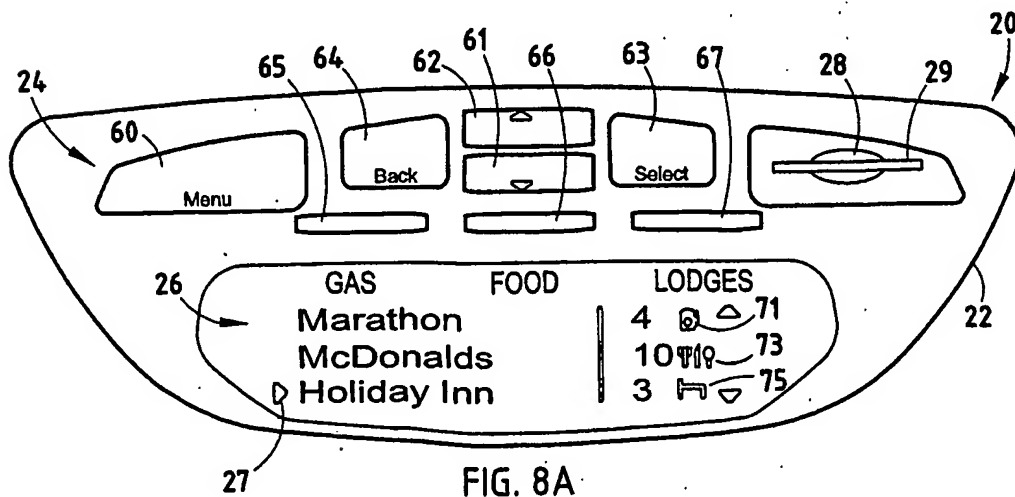


FIG. 8A

5/13

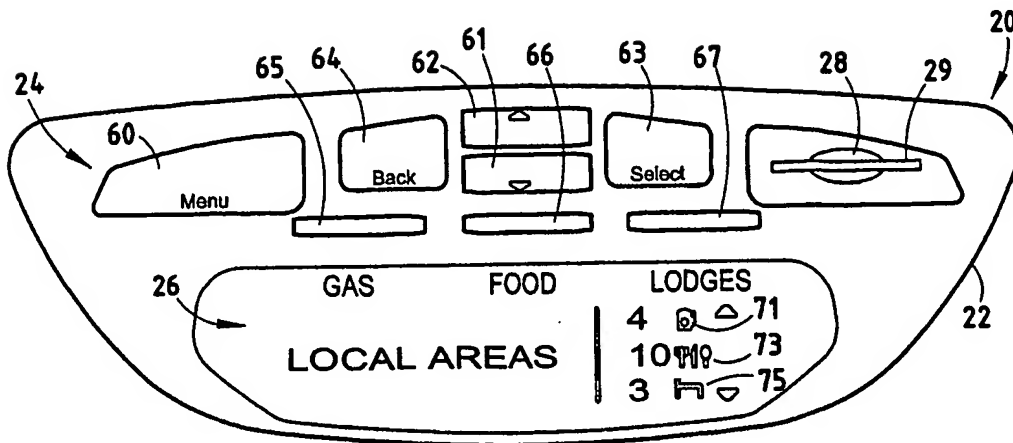


FIG. 8B

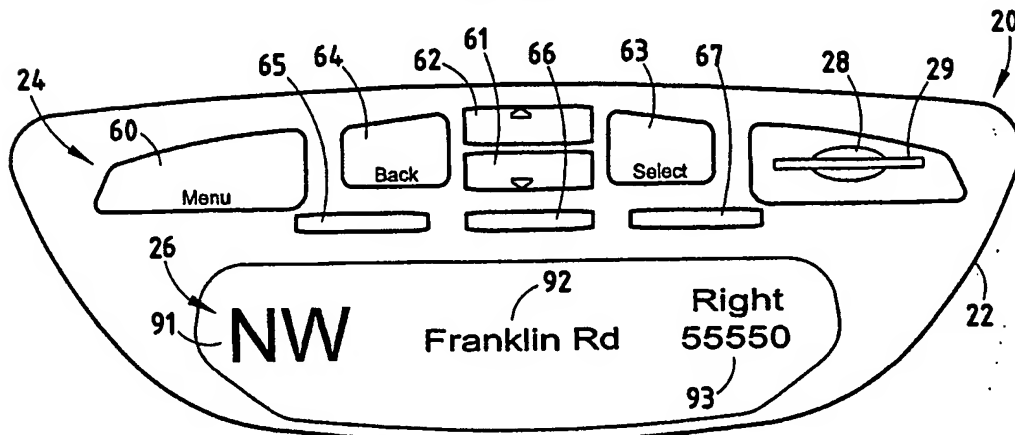


FIG. 9

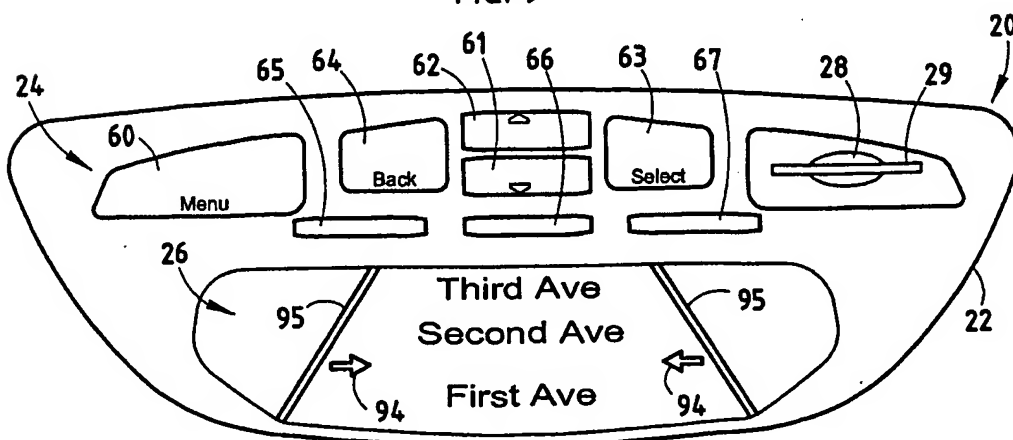


FIG. 10

6/13

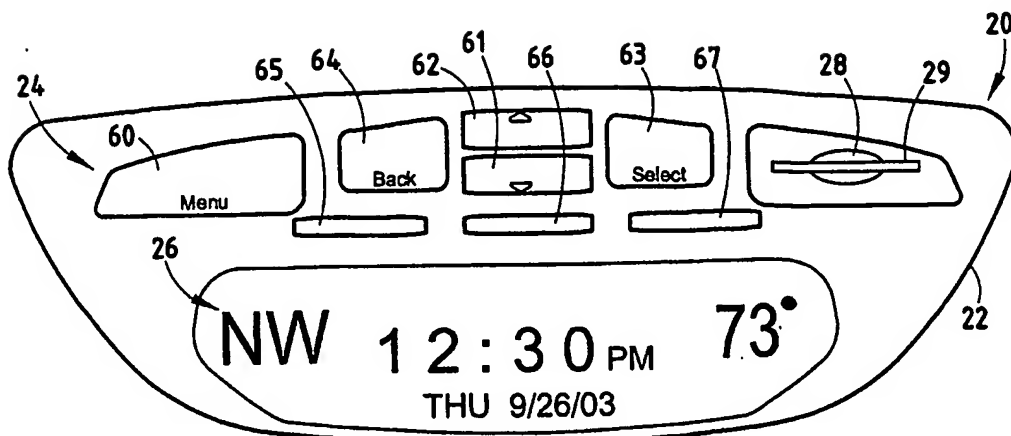


FIG. 11

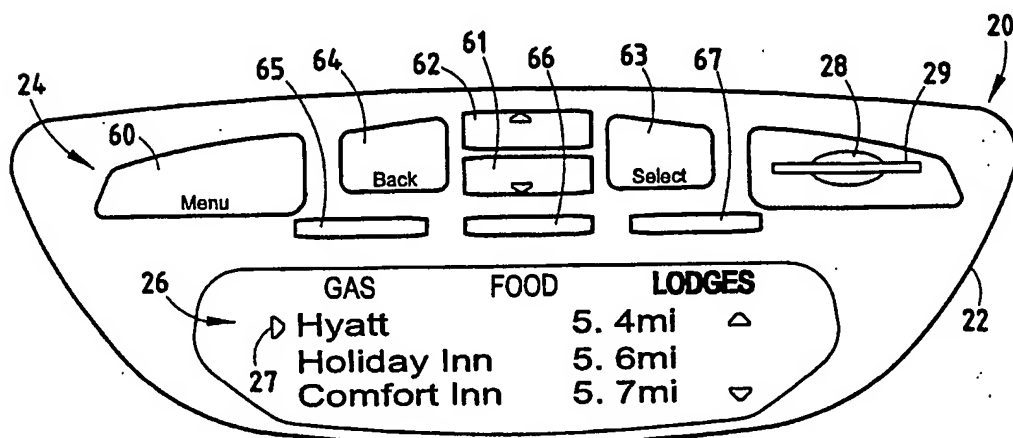


FIG. 12

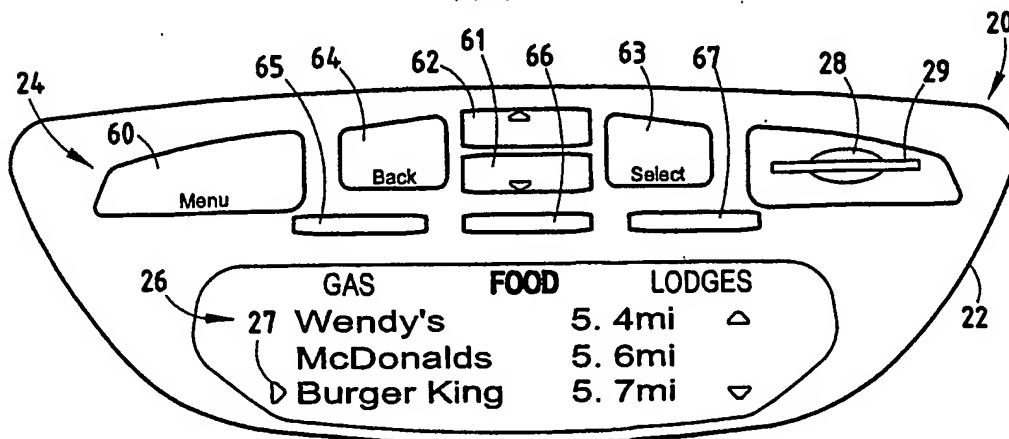


FIG. 13

7/13

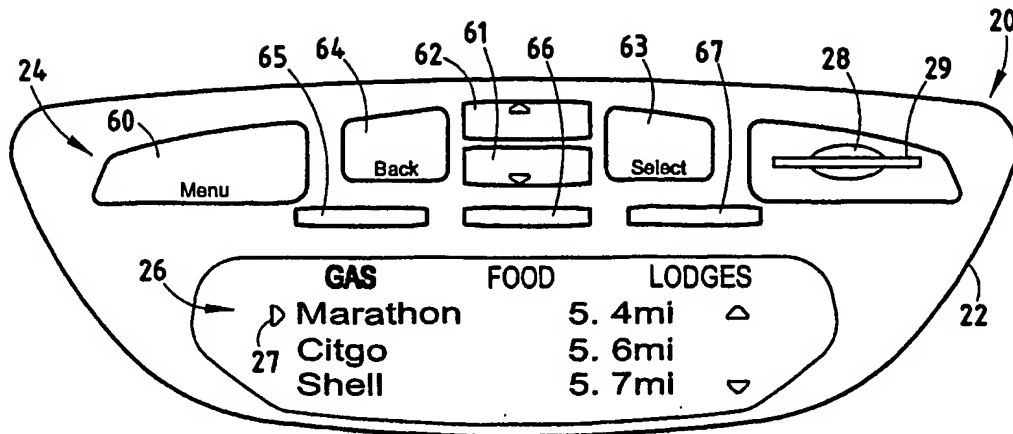


FIG. 14

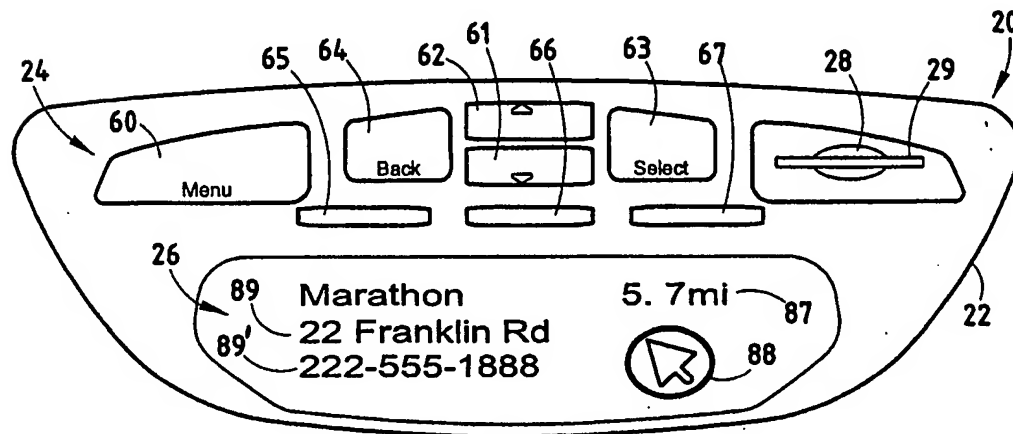


FIG. 15

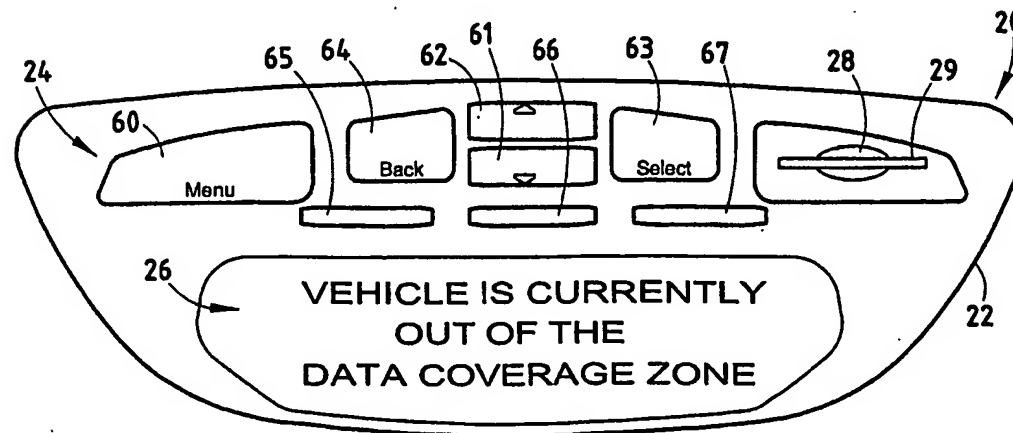


FIG. 16

8/13

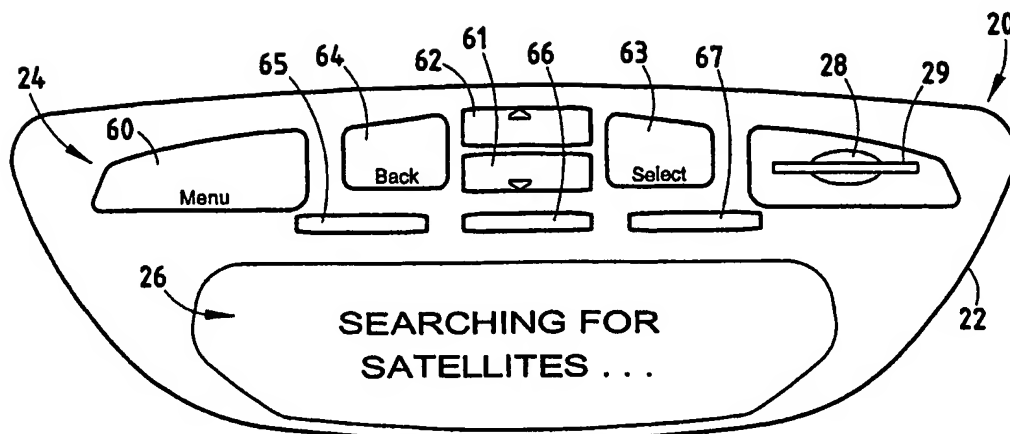


FIG. 17

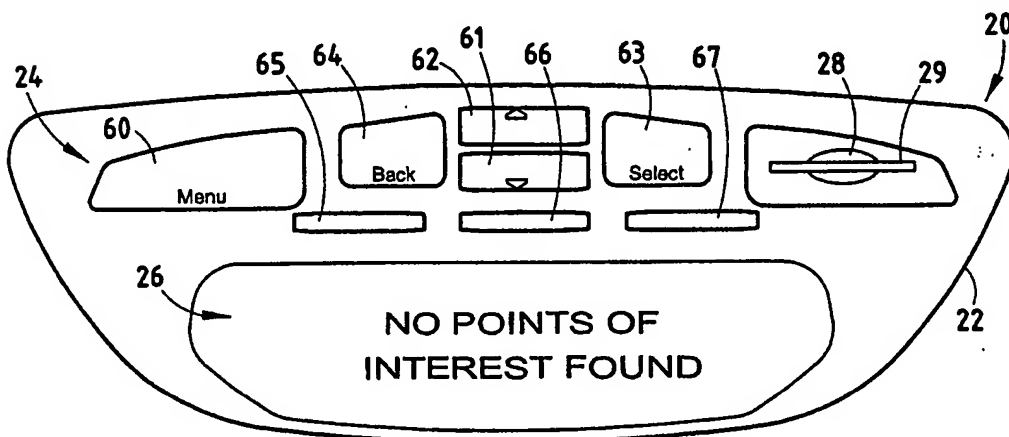


FIG. 18

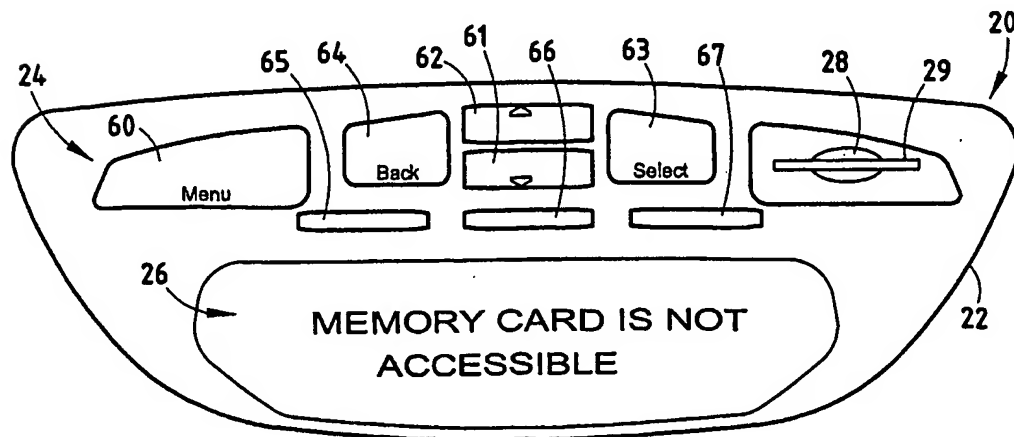


FIG. 19

9/13

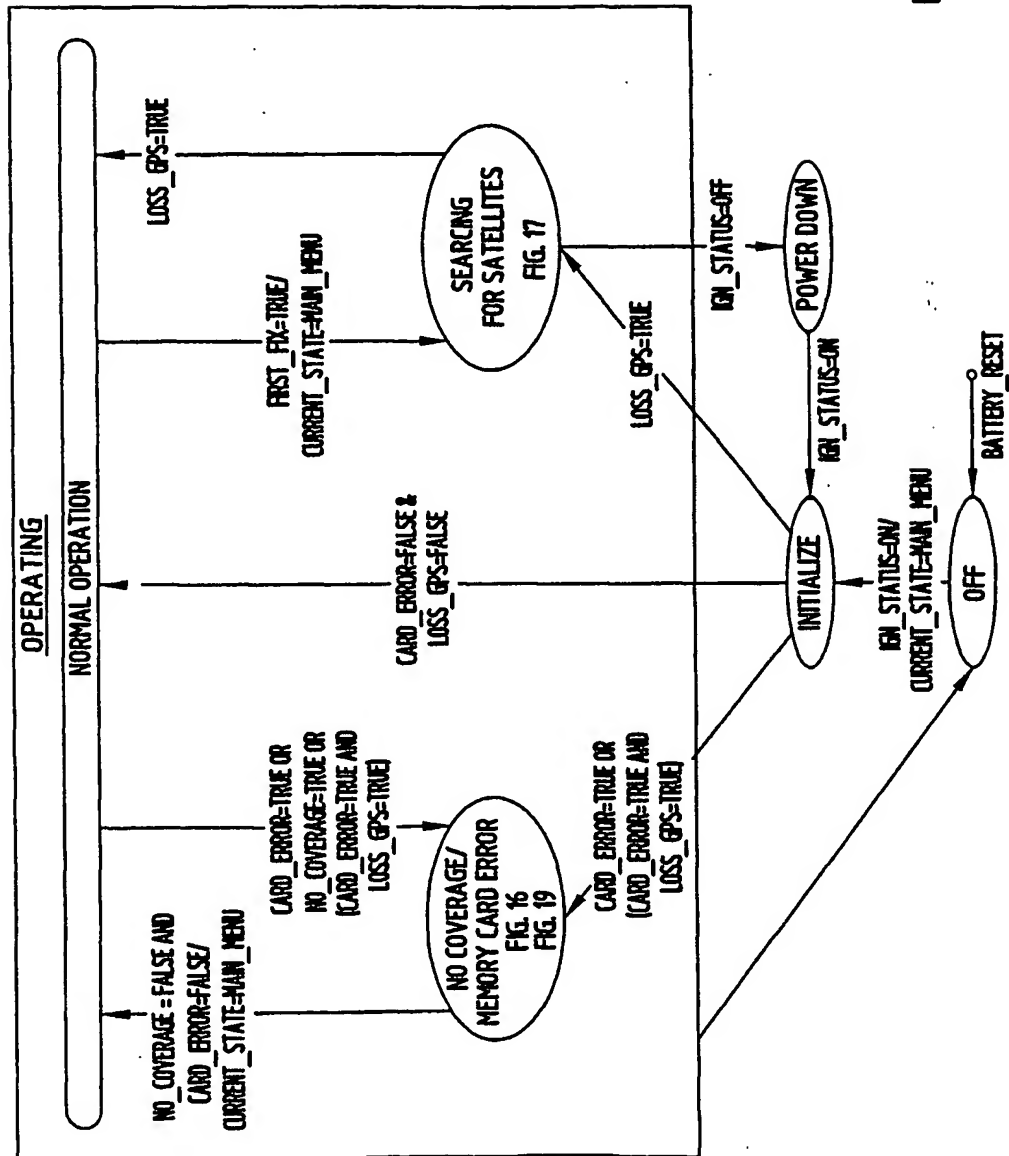


FIG. 20

10/13

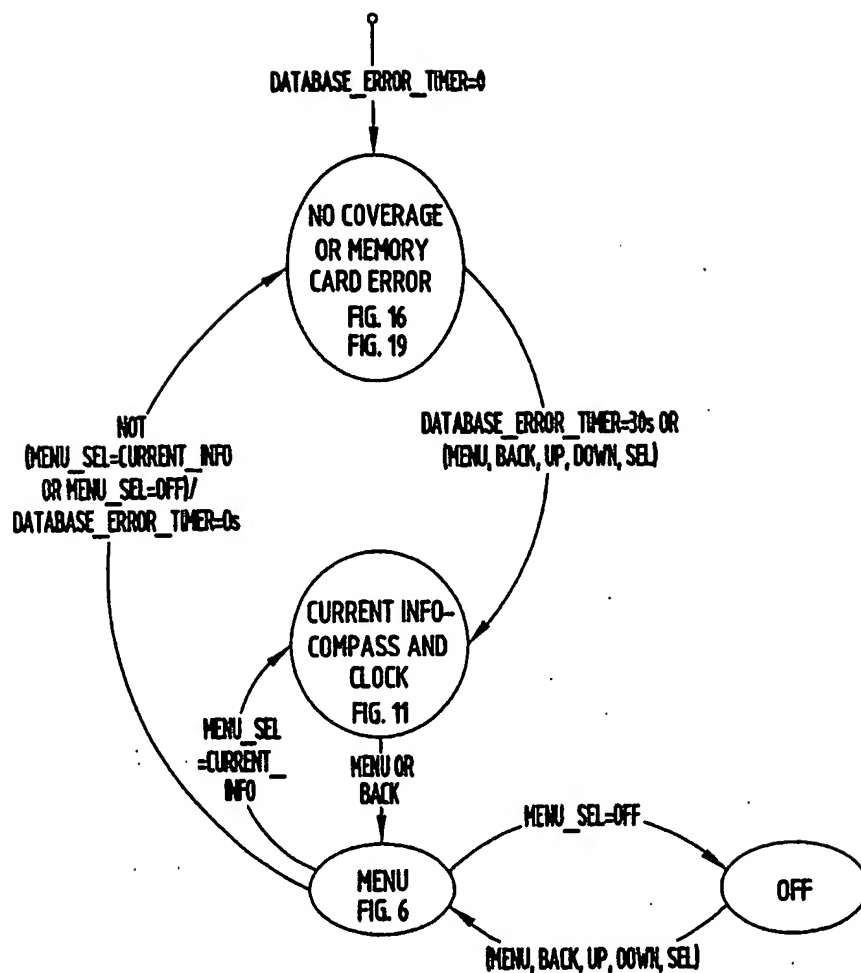


FIG. 21

11/13

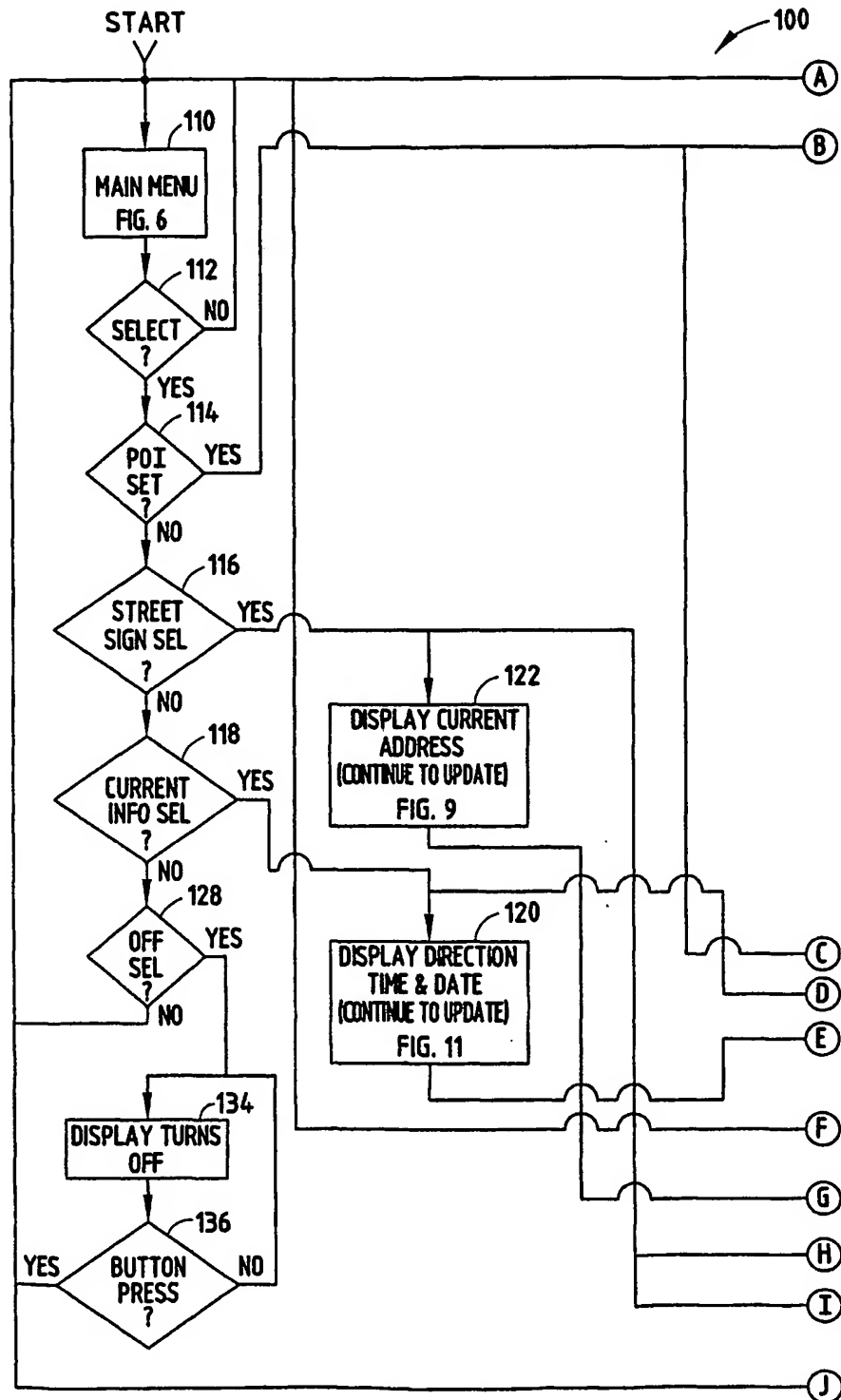


FIG. 22A

12/13

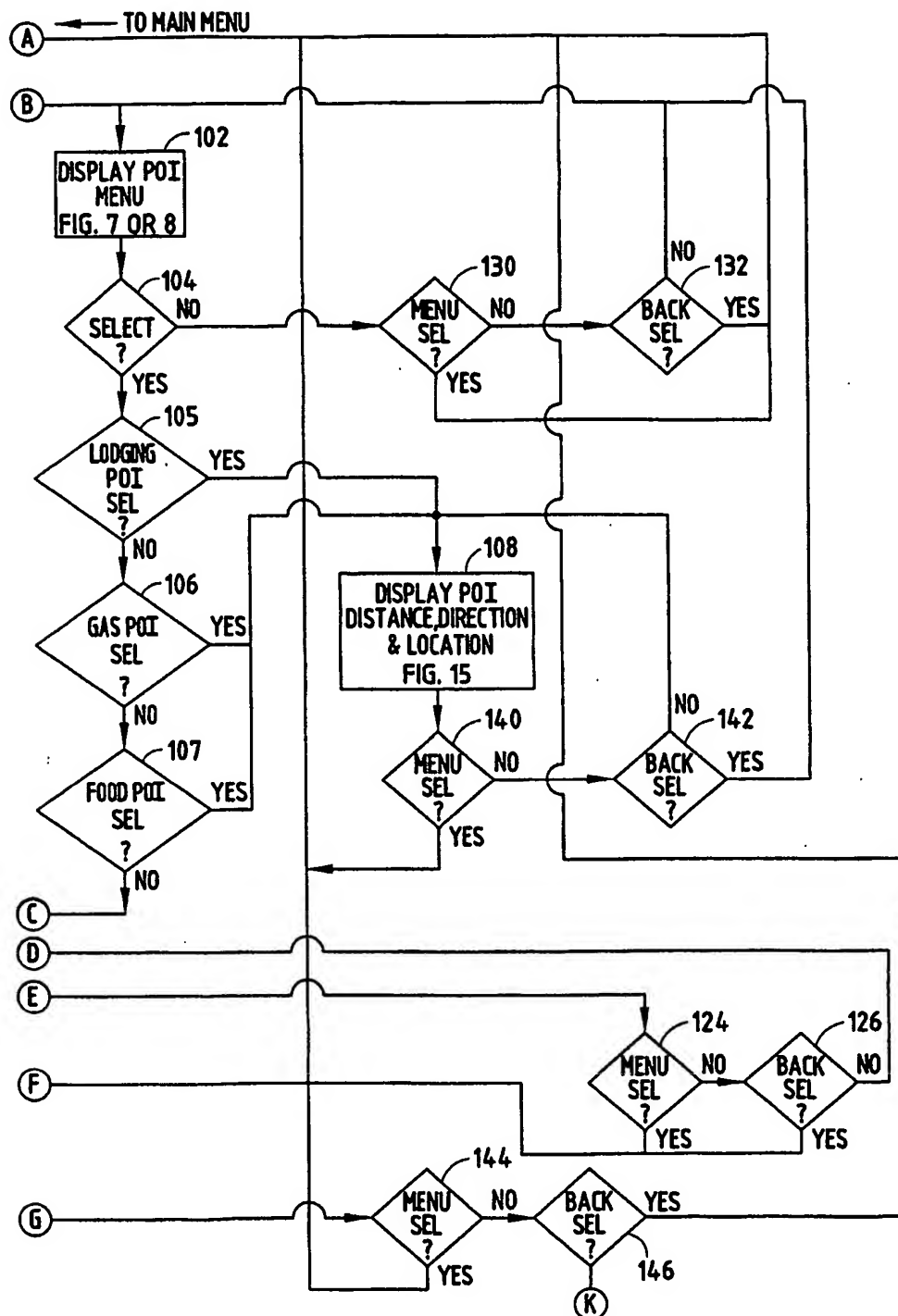


FIG. 22B

13/13

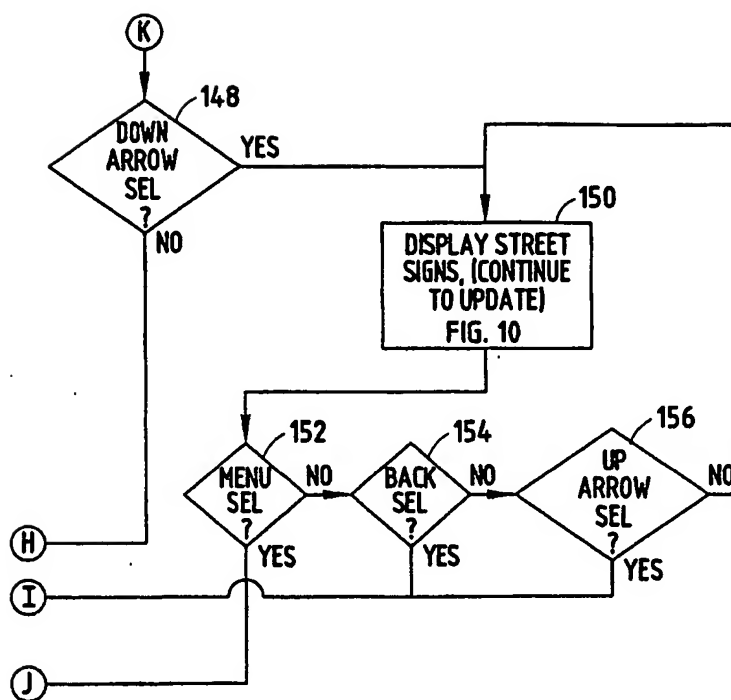


FIG. 22C

ASSIGNMENT - WORLDWIDE

For good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, each undersigned inventor (hereinafter referred to singly and collectively as "ASSIGNOR") has sold, assigned, and transferred, and by these presents hereby sells, assigns, and transfers, unto

Johnson Controls Technology Company
915 East 32nd Street
Holland, Michigan 49423

(hereinafter referred to as "ASSIGNEE") its successors and assigns, the full and exclusive right, title and interest for the United States, its territories and possessions, and all foreign countries in and to this invention relating to

POINT-OF-INTEREST DISPLAY SYSTEM

as set forth in this United States Patent Application

check one ☐ executed concurrently herewith,
 ☐ executed on _____,
 ☒ Serial No. 10/532,025 Filed 04/21/2005

as well as in and to (a) all improvements and modifications of the above-identified invention or inventions, (b) the above-identified application and all other applications for Letters Patent of the United States and countries foreign thereto for above-identified invention or inventions and all improvements and modifications thereof, (c) all Letters Patent which may issue from said applications in the United States and countries foreign thereto, (d) all divisions, continuations, reissues, and extensions of said applications and Letters Patent, and (e) the right to claim for any of said applications the full benefits and priority rights under the International Convention and any other international agreement to which the United States adheres; such right, title, and interest to be held and enjoyed by ASSIGNEE, its successors and assigns, to the full end of the term or terms for which any and all such Letters Patent may be granted as fully and entirely as would have been held and enjoyed by ASSIGNOR had this Assignment not been made.

ASSIGNOR HEREBY AUTHORIZES ASSIGNEE to file patent applications in any or all countries on the above-identified invention or inventions in the name of the undersigned or in the name of ASSIGNEE or otherwise as ASSIGNEE may deem advisable under the International Convention or otherwise.

ASSIGNOR HEREBY AUTHORIZES AND REQUESTS the Commissioner of Patents and Trademarks to issue said Letters Patent to ASSIGNEE as assignee of the entire interest, for the sole use and benefit of ASSIGNEE, its successors and assigns.

ASSIGNOR HEREBY AGREES (a) to communicate to ASSIGNEE, its successors and assigns, or their representative or agents, all facts and information known or available to ASSIGNOR respecting said invention or inventions, improvements, and modifications including evidence for interference, reexamination, reissue, opposition, revocation, extension, or infringement purposes or other legal, judicial, or administrative proceedings, whenever requested by ASSIGNEE; (b) to testify in person or by affidavit as required by ASSIGNEE, its successors and assigns, in any such proceeding in the United States or a country foreign thereto; (c) to execute and deliver, upon request by ASSIGNEE, all lawful papers including, but not limited to, original, divisional, continuation, and reissue applications, renewals, assignments, powers of attorney, oaths, affidavits, and declarations, depositions; and (d) to provide all reasonable assistance to ASSIGNEE, its successors and assigns, in obtaining and enforcing proper title in and protection for said invention or inventions, improvements, and modifications under the intellectual property laws of the United States and countries foreign thereto.

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Executed this _____ day of _____, 20____.

NISA M. ARNOLD-HUYSER

State of _____)
County of _____) ss.

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared NISA M. ARNOLD-HUYSER, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires:

(Seal)

Executed this _____ day of _____, 20____.

IAN MILSTEAD

State of _____)
)ss.
County of _____)

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared IAN MILSTEAD, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original, first, and sole inventor (if only one inventor is named below) or an original, first, and joint inventor (if plural inventors are named below or in an attached Declaration) of the subject matter which is claimed and for which a patent is sought on the invention entitled

POINT-OF-INTEREST DISPLAY SYSTEM

(Attorney Docket No. 026032-4899)

the specification of which (check one)

 is attached hereto.

 X was filed on 10/20/2003 as United States Application Number or
PCT International Application Number 10/532,025
(PCT/US2003/033242)..

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

THAT I do not know and do not believe that the same invention was first patented or made the subject of an inventor's certificate that issued in any country foreign to the United States of America before the filing date of this United States application if the foreign application was filed by me (us), or by my (our) legal representatives or assigns, more than twelve months (six months for design patents) prior to the filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified specification contains a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with

which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number	Country	Foreign Filing Date	Priority Claimed?	Certified Copy Attached?

I HEREBY CLAIM the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

U.S. Provisional Application Number	Filing Date
60/419,934	10/21/2002

I HEREBY CLAIM the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number

I HEREBY APPOINT the registered attorneys and agents at Customer Number

26371

to have full power to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent, and to transact all business in the United States Patent and Trademark Office connected therewith.

I request that all correspondence be directed to:

Jean M. Tibbetts
FOLEY & LARDNER LLP
Customer Number: 26371

Telephone: (414) 297-5531
Facsimile: (414) 297-4900

I UNDERSTAND AND AGREE THAT the foregoing attorneys and agents appointed by me to prosecute this application do not personally represent me or my legal interests, but instead represent the interests of the legal owner(s) of the invention described in this application.

I FURTHER DECLARE THAT all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Name of first inventor	Nisa M. Arnold-Huyser
Residence	Zeeland, Michigan
Citizenship	U.S.A.
Post Office Address	1520 Castlemaine Drive Zeeland, Michigan 49464
Inventor's signature	
Date	

Name of second inventor	Alan S. Hughes
Residence	Holland, Michigan
Citizenship	U.S.A.
Post Office Address	1210 Birdie Lane Holland, Michigan 49423
Inventor's signature	
Date	

Name of third inventor	John S. Bambini
Residence	Kentwood, Michigan
Citizenship	U.S.A.
Post Office Address	5490 Brattleboro Drive, S.E. Kentwood, Michigan 49508
Inventor's signature	
Date	

Name of fourth inventor	Ian Milstead
Residence	Elmhurst, Illinois
Citizenship	U.S.A.
Post Office Address	665 Berkley Avenue Elmhurst, Illinois 60126-4201
Inventor's signature	
Date	

Name of fifth inventor	Susan K. Sondag
Residence	Holland, Michigan
Citizenship	U.S.A.
Post Office Address	2015 Woodlark Drive Holland, Michigan 49424
Inventor's signature	
Date	

Atty. Dkt. No. 026032-4900

ASSIGNMENT - WORLDWIDE

For good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, each undersigned inventor (hereinafter referred to singly and collectively as "ASSIGNOR") has sold, assigned, and transferred, and by these presents hereby sells, assigns, and transfers, unto

Johnson Controls Technology Company
915 East 32nd Street
Holland, Michigan 49423

(hereinafter referred to as "ASSIGNEE") its successors and assigns, the full and exclusive right, title and interest for the United States, its territories and possessions, and all foreign countries in and to this invention relating to

POINT-OF-INTEREST DISPLAY SYSTEM

as set forth in this United States Patent Application

check one ☐ executed concurrently herewith,
 ☐ executed on _____,
 ☒ Serial No. 10/532,287 Filed 04/21/2005

as well as in and to (a) all improvements and modifications of the above-identified invention or inventions, (b) the above-identified application and all other applications for Letters Patent of the United States and countries foreign thereto for above-identified invention or inventions and all improvements and modifications thereof, (c) all Letters Patent which may issue from said applications in the United States and countries foreign thereto, (d) all divisions, continuations, reissues, and extensions of said applications and Letters Patent, and (e) the right to claim for any of said applications the full benefits and priority rights under the International Convention and any other international agreement to which the United States adheres; such right, title, and interest to be held and enjoyed by ASSIGNEE, its successors and assigns, to the full end of the term or terms for which any and all such Letters Patent may be granted as fully and entirely as would have been held and enjoyed by ASSIGNOR had this Assignment not been made.

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Executed this ____ day of _____, 20__.

NISA M. ARNOLD-HUYSER

State of _____)
)ss.
County of _____)

On this ____ day of _____, 20__, before me, a notary public in and for said county, appeared NISA M. ARNOLD-HUYSER, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

Executed this _____ day of _____, 20____.

ALAN S. HUGHES

State of _____)
County of _____)ss.

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared ALAN S. HUGHES, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

Executed this _____ day of _____, 20____.

IAN MILSTEAD

State of _____)
County of _____) ss.

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared IAN MILSTEAD, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

DECLARATION AND POWER OF ATTORNEY

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POINT-OF-INTEREST DISPLAY SYSTEM

(Attorney Docket No. 026032-4900)

the specification of which (check one)

 is attached hereto.

 X was filed on 10/20/2003 as United States Application Number or PCT International Application Number 10/532,287 (PCT/US2003/033256) and was amended on (if applicable).

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

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concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

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U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number

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26371

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Name of first inventor	Nisa M. Arnold-Huyser
Residence	Zeeland, Michigan
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Post Office Address	1520 Castlemaine Drive Zeeland, Michigan 49464
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Date	

Name of second inventor	John S. Bambini
Residence	Kentwood, Michigan
Citizenship	U.S.A.
Post Office Address	5490 Brattleboro Drive, S.E. Kentwood, Michigan 49508
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Date	

Name of third inventor	Alan S. Hughes
Residence	Holland, Michigan
Citizenship	U.S.A.
Post Office Address	1210 Birdie Lane Holland, Michigan 49423
Inventor's signature	
Date	

Name of fourth inventor	Ian Milstead
Residence	Elmhurst, Illinois
Citizenship	U.S.A.
Post Office Address	665 Berkley Avenue Elmhurst, Illinois 60126-4201
Inventor's signature	
Date	

Name of fifth inventor	Susan K. Sondag
Residence	Holland, Michigan
Citizenship	U.S.A.
Post Office Address	2015 Woodlark Drive Holland, Michigan 49424
Inventor's signature	
Date	

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Holland, Michigan 49423

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POINT OF INTEREST DISPLAY SYSTEM

as set forth in this United States Patent Application

check one ☐ executed concurrently herewith,
 ☐ executed on _____,
 ☒ Serial No. 10/532,199 Filed 04/21/2005

as well as in and to (a) all improvements and modifications of the above-identified invention or inventions, (b) the above-identified application and all other applications for Letters Patent of the United States and countries foreign thereto for above-identified invention or inventions and all improvements and modifications thereof, (c) all Letters Patent which may issue from said applications in the United States and countries foreign thereto, (d) all divisions, continuations, reissues, and extensions of said applications and Letters Patent, and (e) the right to claim for any of said applications the full benefits and priority rights under the International Convention and any other international agreement to which the United States adheres; such right, title, and interest to be held and enjoyed by ASSIGNEE, its successors and assigns, to the full end of the term or terms for which any and all such Letters Patent may be granted as fully and entirely as would have been held and enjoyed by ASSIGNOR had this Assignment not been made.

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Executed this _____ day of _____, 20____.

JOHN S. BAMBINI

State of _____)
)ss.
County of _____)

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared JOHN S. BAMBINI, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

Executed this _____ day of _____, 20____.

IAN MILSTEAD

State of _____)
)ss.
County of _____)

On this _____ day of _____, 20____, before me, a notary public in and for said county, appeared IAN MILSTEAD, who is personally known to me to be the same person whose name is subscribed to the foregoing instrument, and he/she acknowledged that he/she signed, sealed, and delivered the said instrument as his/her free and voluntary act for the uses and purposes therein set forth.

Notary Public

My Commission Expires: _____

(Seal)

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original, first, and sole inventor (if only one inventor is named below) or an original, first, and joint inventor (if plural inventors are named below or in an attached Declaration) of the subject matter which is claimed and for which a patent is sought on the invention entitled

POINT OF INTEREST DISPLAY SYSTEM

(Attorney Docket No. 026032-4901)

the specification of which (check one)

 is attached hereto.

 X was filed on 10/20/2003 as United States Application Number or PCT International Application Number 10/532,199 (PCT/US2003/033284) and was amended on (if applicable).

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

THAT I do not know and do not believe that the same invention was first patented or made the subject of an inventor's certificate that issued in any country foreign to the United States of America before the filing date of this United States application if the foreign application was filed by me (us), or by my (our) legal representatives or assigns, more than twelve months (six months for design patents) prior to the filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified specification contains a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with

which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number	Country	Foreign Filing Date	Priority Claimed?	Certified Copy Attached?

I HEREBY CLAIM the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

U.S. Provisional Application Number	Filing Date
60/419934	10/21/2002

I HEREBY CLAIM the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number
	PCT/US2003/033284	10/20/2003	

I HEREBY APPOINT the registered attorneys and agents at Customer Number

26371

to have full power to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent, and to transact all business in the United States Patent and Trademark Office connected therewith.

I request that all correspondence be directed to:

Jean M. Tibbetts
FOLEY & LARDNER LLP
Customer Number: 26371

Telephone: (414) 297-5531
Facsimile: (414) 297-4900

I UNDERSTAND AND AGREE THAT the foregoing attorneys and agents appointed by me to prosecute this application do not personally represent me or my legal interests, but instead represent the interests of the legal owner(s) of the invention described in this application.

I FURTHER DECLARE THAT all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Name of first inventor	Nisa M. Arnold-Huyser
Residence	Zeeland, Michigan
Citizenship	U.S.A.
Post Office Address	1520 Castlemaine Drive Zeeland, Michigan 49464
Inventor's signature	
Date	

Name of second inventor	Alan S. Hughes
Residence	Holland, Michigan
Citizenship	U.S.A.
Post Office Address	1210 Birdie Lane Holland, Michigan 49423
Inventor's signature	
Date	

Name of third inventor	John S. Bambini
Residence	Kentwood, Michigan
Citizenship	U.S.A.
Post Office Address	5490 Brattleboro Drive, S.E. Kentwood, Michigan 49508
Inventor's signature	
Date	

Name of fourth inventor	Ian Milstead
Residence	Elmhurst, Illinois
Citizenship	U.S.A.
Post Office Address	665 Berkley Avenue Elmhurst, Illinois 60126-4201
Inventor's signature	
Date	

Name of fifth inventor	Susan K. Sondag
Residence	Holland, Michigan
Citizenship	U.S.A.
Post Office Address	2015 Woodlark Drive Holland, Michigan 49424
Inventor's signature	
Date	



PRINCE

EMPLOYEE INNOVATION AND
NON-DISCLOSURE AGREEMENT

In consideration of my original and/or further employment with Prince and of the salary or wages paid to me, I agree:

- a to disclose and assign to Prince all inventions and technical or business innovations conceived or developed by me or jointly with others within the period of my employment, that relate to in any way the company's present and known products, processes, or machines, whether they are existing or reasonably anticipated.
- b to execute, upon the company's request and expense, all necessary papers and provide proper assistance during or subsequent to my employment, to enable the company to obtain for itself any patents, copyrights, or other legal protection for such inventions or innovations.
- c to make and maintain for the company adequate and current written records of all such inventions or innovations.
- d not to use, publish, or otherwise disclose (except as required in my normal company duties), either during or subsequent to my employment, any secret or confidential information or data concerning the company, its products and processes, or its customers.
- e to, upon my termination of employment, promptly deliver to the company all drawings, blueprints, manuals, letters, notes, note boards, reports and all materials of a secret or confidential nature, relating to the company's business, and which are in my possession or control.

Witness: Prince ShermanSignature: John L. BambasDate: 12-2-96

Reichenberger, Karl F.

From: Bambini, John (AGRE) [John.Bambini@smiths-aerospace.com]
Sent: Wednesday, January 31, 2007 11:39 AM
To: St. Clair, Nathaniel
Cc: Reichenberger, Karl F.
Subject: RE: Assignments and Declarations and Power of Attorney for Patent Applications

Nathaniel,

I told Jody a long time ago to take my name off of this application. I thanked her for the opportunity to be included. I went through this process on 2 other patent applications subsequent to my leaving JCI. In those cases, Todd Witkowski and Susan Sondag took the time to contact me before being told to sign or be forever harassed. The customary thank you (a simple plaque) from JCI on those past 2 patents efforts has not been received (probably because I am not an employee of JCI). Instead, I received a dollar (the minimum to make it legal). That does not pay for the notarization and shipping of documents (let alone my time). I work in the aerospace industry now on a very important project. What little time I have outside of my many hours per week at the company, I do not want to spend running around on JCI's behalf for a dollar (or even four). I have not been afforded the means from either Miss Jody or yourself the method to request reimbursement for my expense. I did not even get paid for my remaining vacation from JCI (not an issue here, I just wanted to toss that in).

If you want me to sign, you have my address, make an appointment, come on over, and I'll make coffee and I'll sign.

John

From: St. Clair, Nathaniel [mailto:NStClair@foley.com]
Sent: Wednesday, January 31, 2007 11:19 AM
To: Bambini, John (AGRE)
Cc: Reichenberger, Karl F.
Subject: Assignments and Declarations and Power of Attorney for Patent Applications

Re: Assignments & Declarations and Power of Attorney for Patent Applications
Applicant: Arnold-Huyser et al.
Title: POINT-OF-INTEREST DISPLAY SYSTEM
Filing Date: April 21, 2005
F&L File Nos.: 026032-4899, 026032-4900, 026032-4901

Dear Mr. Bambini:

I represent Johnson Controls, Inc. ("JCI"), in the above-referenced patent matters. I have attempted to contact you on multiple occasions to remind you of your obligations to JCI, regarding the execution of certain necessary papers for the above-referenced patent matters.

Per the attached document entitled "Employee Innovation and Non-Disclosure Agreement," you entered into an agreement with Prince Corporation (now owned by JCI) to execute "all necessary papers and provide proper assistance during or subsequent to your employment, to

3

enable the company to obtain for itself patents, copyrights, or other legal protection for such inventions or innovations."

I have also attached the necessary papers for you to execute, including the (i) Assignments and (ii) Declarations and Power of Attorney for each of the above-referenced patent applications, in order for you to comply with your contractual obligations to JCI. I have also enclosed complete copies of the patent applications, including the specification, claims, and drawings. Your immediate attention and return of the executed documents via facsimile prior to Wednesday, February 7, 2007, would be greatly appreciated. The originals should be returned via mail courier soon thereafter. If you have any questions regarding the content of this letter or any other communication(s) regarding this matter, please do not hesitate to contact me.

Best regards,

Nathaniel St. Clair II

Nathaniel St. Clair, II
Foley & Lardner LLP
777 East Wisconsin Avenue
Milwaukee, Wisconsin 53202-5306
Phone: 414.297.5845
Fax: 414.297.4900
nstclair@foley.com

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Atty. Dkt. No. 026032-4899

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Arnold-Huyser et al.
Title: POINT-OF-INTEREST DISPLAY
SYSTEM
Appl. No.: 10/532,025
International Filing Date: 4/21/2005
371(c) Date:
Examiner: To Be Determined
Art Unit: To Be Determined

CERTIFICATE OF EXPRESS MAILING
I hereby certify that this correspondence is being deposited with the United States Postal Service's "Express Mail Post Office To Addressee" service under 37 C.F.R. § 1.10 on the date indicated below and is addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

EV 828707949 US 10/16/06
(Express Mail Label Number) (Date of Deposit)

Carolyn Simpson

(Printed Name)


(Signature)**AFFIDAVIT**

STATE OF Michigan)
COUNTY OF Ottawa)SS

I, Jodi A. Hemmeke, being duly sworn, do hereby depose and say as follows:

- 1) I am an employee of Johnson Controls Interiors LLC ("JCI") and have been employed at JCI for a total of 17 years, previously as an Administrative Assistant in the Intellectual Property Department.
- 2) In my role as an Administrative Assistant, I regularly corresponded with the inventor/patentee(s) and supervised the execution of various patent-related documents, such as declarations of inventorship, powers of attorney, assignments, etc., for certain patent applications filed on behalf of Johnson Controls Technology Company.

- 3) In the above-captioned application, there are five named inventors, including Mr. John S. Bambini. Each of the five named inventors have been contacted to review the aforementioned patent application and to execute declarations of inventorship, powers of attorney, and assignment documents relating to this patent application.
- 4) On or around December 9, 2005, I attempted to contact Mr. Bambini via letter to request his cooperation with the review of the patent application and the execution of a declaration of inventorship, a power of attorney, and an assignment, relating to the aforementioned patent application.
- 5) Upon receiving no response from Mr. Bambini, I contacted Mr. Bambini via e-mail (at John.Bambini@smiths-aerospace.com), in order to verify whether he had reviewed the patent application and executed and returned the declaration, power of attorney, and assignment.
- 6) On December 18, 2005, I received a response from Mr. Bambini via e-mail, indicating that he "decided not to sign" the aforementioned documents relating to this patent application. (*See Exhibit A.*)
- 7) On December 20, 2005, I responded to Mr. Bambini informing him of his contractual obligations to JCI, regarding execution of certain necessary papers relating to this patent application, as required by his employment agreement. (*See Exhibit B.*)
- 8) On January 13, 2006, I attempted to contact Mr. Bambini again to inquire whether he had executed the declaration and assignment. I received no response from Mr. Bambini. Attached to the January 13th correspondence was Mr. Bambini's signed employment agreement. (*See Exhibits C and D.*)
- 9) On February 7, 2006, a certified letter, including the aforementioned patent application, a declaration of inventorship, a power of attorney, and an assignment, was sent with a return-receipt request, to Mr. Bambini's last known residence . The

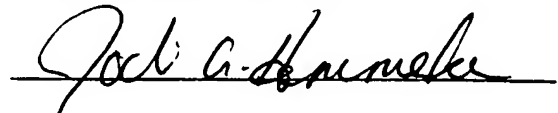
letter and all enclosures were returned to sender as "unclaimed." (See Exhibit E, F, and G, which include a copy of the letter, a copy of the return-receipt, and a copy of the face of the envelope.)

10) On June 22, 2006, I resent a declaration of inventorship, a power of attorney, and an assignment to Mr. Bambini via e-mail (at John.Bambini@smiths-aerospace.com). (See Exhibit H.)

11) I received no response from Mr. Bambini, and I have had no other communication with Mr. Bambini since my June 22nd correspondence.

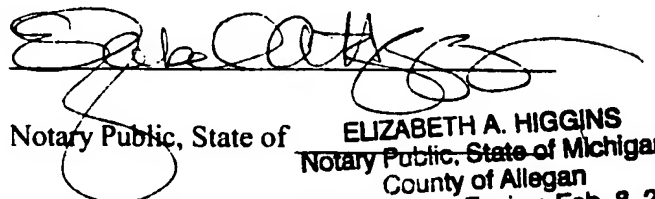
12) To the full extent of my knowledge, Mr. Bambini has refused to sign the declaration, power of attorney, and assignment for the above captioned application.

Sworn and subscribed to by:



Jodi A. Hemmeke

On this 11th day of October 2006, before me personally appeared JODI A. HEMMEKE, known to me to be the individual described herein and who executed the foregoing instrument for the purposes set forth herein.



Notary Public, State of Michigan **ELIZABETH A. HIGGINS**
Notary Public, State of Michigan
County of Allegan
My Commission Expires **Feb. 8, 2012**
Acting in the County of Ottawa